The Journal of ELECTRICITY POWER and GAS

DEVOTED TO THE CONVERSION, TRANSMISSION and DISTRIBUTION OF ENERGY.

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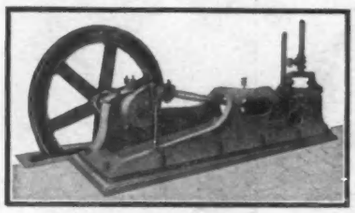

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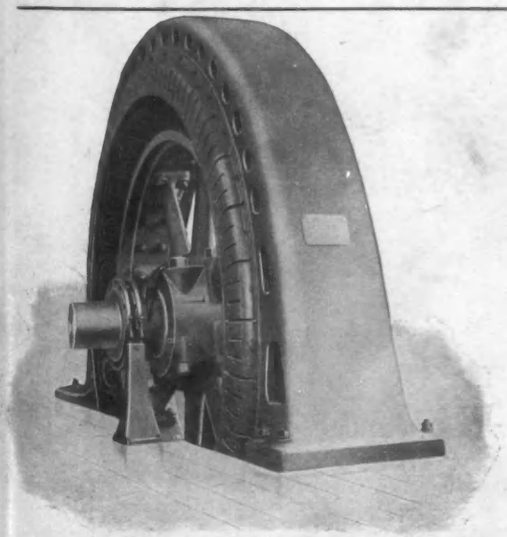

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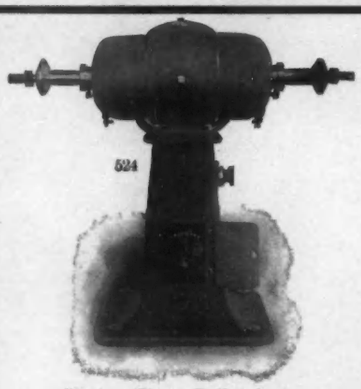

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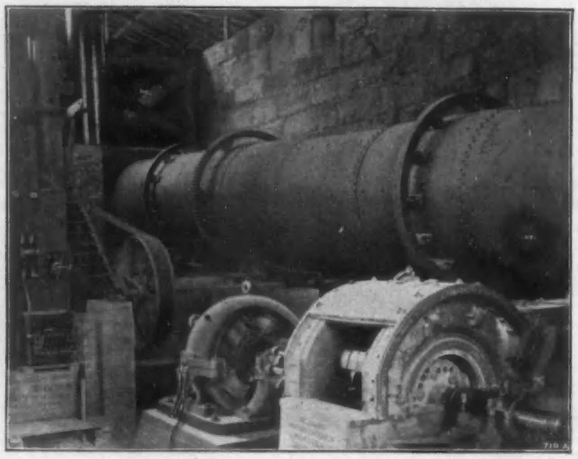

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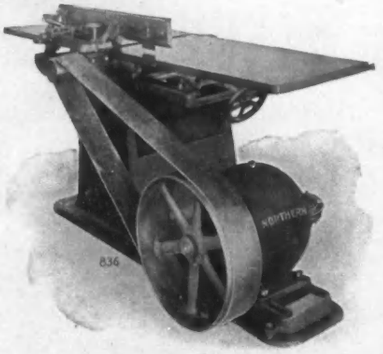

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VOLUME XIV. SAN FRANCISCO, CAL., JULY, 1904. NUMBER 7

In Eighth Annual Convention Assembled.

Being an Installment of the Invaluable Papers Presented Before the Monterey Meeting of the Pacific Coast Electric Transmission Association, June 21-22, 1904.

ADDRESS OF WELCOME.

BY HON. R. F. JOHNSON, MAYOR OF THE CITY OF MONTEREY, CAL.

IN behalf of the people of the city of Monterey, I assure you it is more than an honor for me to cordially welcome the members of the Pacific Coast Electric Transmission Association assembled here in this, one of the most historic and picturesque places of the State of California. It was here in the beautiful bay of Monterey, in its calm and emerald waters, where Commodore John Drake Sloat anchored his squadron, consisting of three sailing sloops, or ships of war, in July, 1846, and with 250 marines and seamen went ashore and in the name of the United States raised the Stars and Stripes over the Custom House, where they have waved ever since. A few blocks away from here you behold Colton Hall; it was there the first constitutional convention convened, composed of delegates who migrated here from nearly every State in the Union and framed our State paper that all Californians read with pride to the present day. A little to the northwest, and within our city limits, can be seen traces of an old Mexican fort with its antiquated guns and trenches. This place was occupied, also, by Generals Fremont, Halleck and Lieutenant Sherman in 1846. Today this historic site is barricaded and occupied by the 15th Infantry, who are exercising the arts of war in order to preserve peace. To the east, and within a few blocks, is the famous Del Monte, unsurpassed in its landscape scenery, fragrant with the perfume of beautiful bright colored flowers, and a most healthful climate. It is, then, in this delightful garden-like spot, we most heartily welcome you in your deliberations on this the most important question of the transmission of power by electricity, and hope your visit will be long remembered for its usefulness and the pleasant time you will enjoy among us.

The question of electric transmission is not only of the greatest importance to every progressive municipality, but the great problems of municipal sanitation, lighting and power are interwoven with it. There is nothing in modern or ancient times which conduces as much to health, convenience and comfort, as well as the pleasure and happiness of the inhabitants of a city, than this question of electrical transmission. It closely unites the suburb with the heart of the town. It has shortened the distance between remote parts of the city by means of the electric cars, which pass along with that rapidity and comfort and cleanliness as if we were riding in splendidly equipped carriages. The wonderful changes produced by electric transmission in our cities are beyond calculation. This mysterious electric current has literally, as well as figuratively, electrified our cities and towns with light and motion and imbued them with new life, and the cities blessed with this new life-given electric fluid have become more than a dream of the past; and we today stand with wonderment and amazement at the magical changes continually transpiring before our eyes through the medium of this mysterious power.

Our own city of Monterey has experienced and felt the wonderful transformation which electric transmission can bring and accomplish. Monterey, sometime in the past known as

"Sleepy Hollow," has received a current of this vital, invigorating, magical fluid, and we now have a wide-awake modern city with all improvements that electricity can bestow, with bright hopes for the future of greater development and growth. The bright and cheerful vision of the still greater changes and possibilities the future will bring in useful inventions and astonishing improvements for the benefit of mankind, which will redound to his greater well-being, can only be pictured and painted by those, no other than whom are more qualified than the members of this Association who are now gathered here.

Again I welcome you in our midst with the best of wishes of the citizens of the city of Monterey.

A PROPOSED METHOD OF DETERMINING METER RATES FOR THE SALE OF CURRENT, WITH AN EXAMPLE FROM DATA OF A LARGE STEAM DRIVEN PLANT.*

BY A. M. HUNT.

IN 1899, a paper was read before this Association by C. W. Hutton "On the Determination of a Fair Return for Current Supply," which contained many suggestions worthy of study. While general manager of the Independent Electric Light and Power Co., I worked out a system, somewhat similar to that proposed by Mr. Hutton but involving in its application some features which I believe to be original. This system was never put into operation, but a number of persons to whom it has been shown have urged that it be given publicity. In response to a request from your executive committee for a paper, I lay it before you. I do not premise that the system, as outlined, fills the "long felt want," and invite full criticism.

The cost of producing current in any plant may be divided into manufacturing, distribution and general expense items.

Manufacturing expense may be divided into two parts, stand-by and production costs. There is a certain part of the manufacturing costs which consists in the readiness to do business, and may be considered as the cost of turning out the first kilowatt-hour. This may be arrived at by a method devised by an English writer whose name I have forgotten.

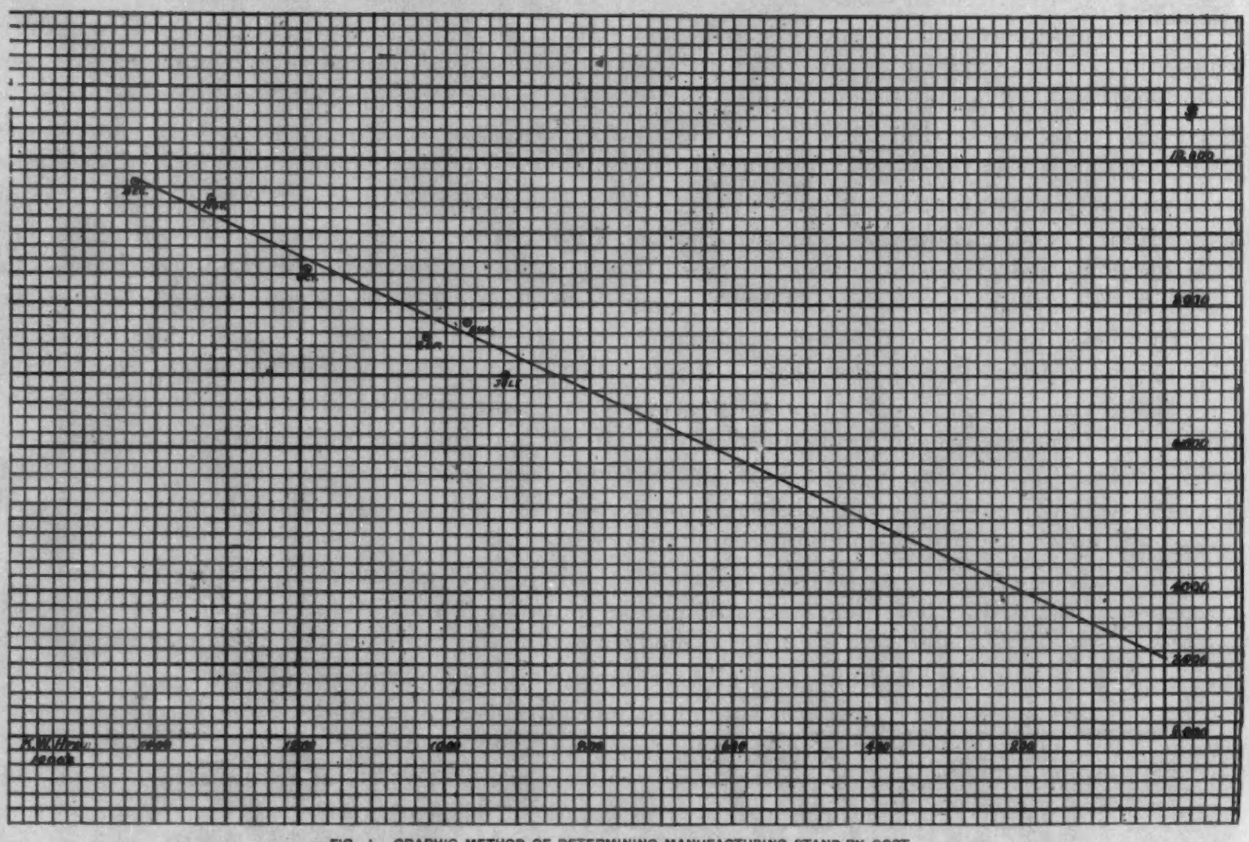

FIG. 1. GRAPHIC METHOD OF DETERMINING MANUFACTURING STAND-BY COST.

Referring to Figure 1, points are plotted from results over a series of months, abscissæ being kilowatt-hours

*A paper presented to the Eighth Annual Convention of the Pacific Coast Electric Transmission Association, June 21-22, 1904.

generated during the months, and ordinates the total manufacturing cost each month in dollars. An average line through these points intersects the axis of × at a height which represents the total stand-by cost, and the difference between this amount and the total manufacturing cost for any month gives the item called production cost. Similarly, distribution expense may be divided into stand-by and production items. For the purpose of arriving at the basis of rates, different items will be designated by letters as follows:

A = Total manufacturing stand-by cost.

B = Total manufacturing production cost.

C = Total interest and depreciation charge, plus taxes and insurance.

D = Total distribution stand-by cost.

E = Total distribution production cost.

G = Total general expense, less interest, depreciation, taxes and insurance.

n = Number of consumers connected.

x = Total kilowatt capacity connected to lines.

y = Kilowatt capacity connected by consumer whose rate is to be determined.

z = Number of kilowatt-hours sold during period of time for which above costs are taken.

r = Kilowatt capacity connected by consumer whose rate is to be determined.

s = Number of kilowatt-hours used during month by consumer whose rate is to be determined.

Each consumer, regardless of the size of his installation should pay an equal share of items E and G. This, I think, will be granted if you consider what constitute these items. Each kilowatt-capacity connected should pay an equal portion of items A, C, and D.

Each kilowatt-hour sold should bear a charge equal to $\frac{B}{z}$

Difference of opinion may exist as to the above proportioning of items, but this does not affect the general scheme.

The value of the different charges in the specific case under consideration are given below as taken covering a period of six months.

$\frac{E+G}{n}$ = \$1.53949 per month to each consumer.

$\frac{A+C+D}{x}$ = \$2.72456 per month for each kilowatt connected.

$\frac{B}{z}$ = 0.57225 cents per kilowatt-hour sold.

The rate for any consumer, during any month will then be

$$\frac{B}{z}+\left[\frac{E+G}{n}+\frac{A+C+D}{x}\times r\right]\div s$$

The rate so determined should be modified by arbitrarily assuming an upper and lower limit beyond which the rate shall not go. The upper limit will usually be determined by the maximum rate allowed by municipal or other regulation. The lower limit should be placed at a point to compete with the cost of production in isolated plants, or other competing sources. I have taken an upper limit of 10 cents, and a lower limit of 3 cents per kilowatt-hour.

A curve can be plotted for any consumer showing the rate to be charged for any given monthly consumption. Such a curve for a consumer having a connected load, equivalent to five kilowatts, is shown in Figure 2.

It will be noted that until the consumer's use reaches 156 kilowatt-hours for the month, he is charged at the rate of 10 cents. If he uses 300 kilowatt-hours during the month his rate falls to 5.7 cents. If he uses 610 kilowatt-hours his rate falls to 3 cents. Beyond this use he gets no reduction of rate.

It would be a practical impossibility to plot these curves for each individual consumer, but if logarithmic cross-section paper be used, these curves become straight lines, and individual curves can be established and successfully used, as I have demonstrated by experimental test.

Figure 3 shows the curve of a consumer having five kilowatts capacity of connected load, plotted on the logarithmic cross-section paper.

A table can readily be prepared showing the kilowatt-hours used at which the rates of consumers of different kilowatt capacities start below the 10 cent line, and where they intersect the 3 cent line. Given such a table, mark these two points and draw a straight between them and you have the curve. As a suggestion for the practical use of the system, the following method can be pursued. On the back of the contract forms used, can be printed the logarithmic cross-section chart. Classify all consumers by steps. Count none less than one kilowatt capacity, and increasing to ten kilowatts capacity by steps of one kilowatt. From ten kilowatts to thirty kilowatts by steps of two and one-half kilowatts, and from thirty kilowatts to seventy-five kilowatts by steps of five kilowatts. This would call for a table, such as indicated above, covering twenty-seven different capacities.

A prospective consumer comes in and wants a contract, and asks for a rate. Ascertain his connected capacity, and by reference to the table, mark the two points, and connect with a straight line. The rate is established and it is a just one both to consumer and company.

In determining the rate to be charged each month, in the experiment tried by me, I had an enlarged logarithmic chart mounted on a drawing board and on it were drawn the twenty-seven lines as above noted. The scale of cents was printed on the edge of a tee square used with the board. Each consumer's record was, in our system, kept on a card giving consumption, and amount of monthly bills. These cards also showed the consumer's connected capacity. One clerk would call off from the card the consumer's connected load, and his monthly consumption. A second clerk would slide his square along to the proper point, corresponding to use, and call back the rate in cents as shown on the edge of the square at point where it crossed the line showing capacity connected.

This sounds as if it were rather cumbersome, but in actual practice the work was done rapidly and accurately. There will always be consumers whose cases will call for special consideration, but I believe that the described

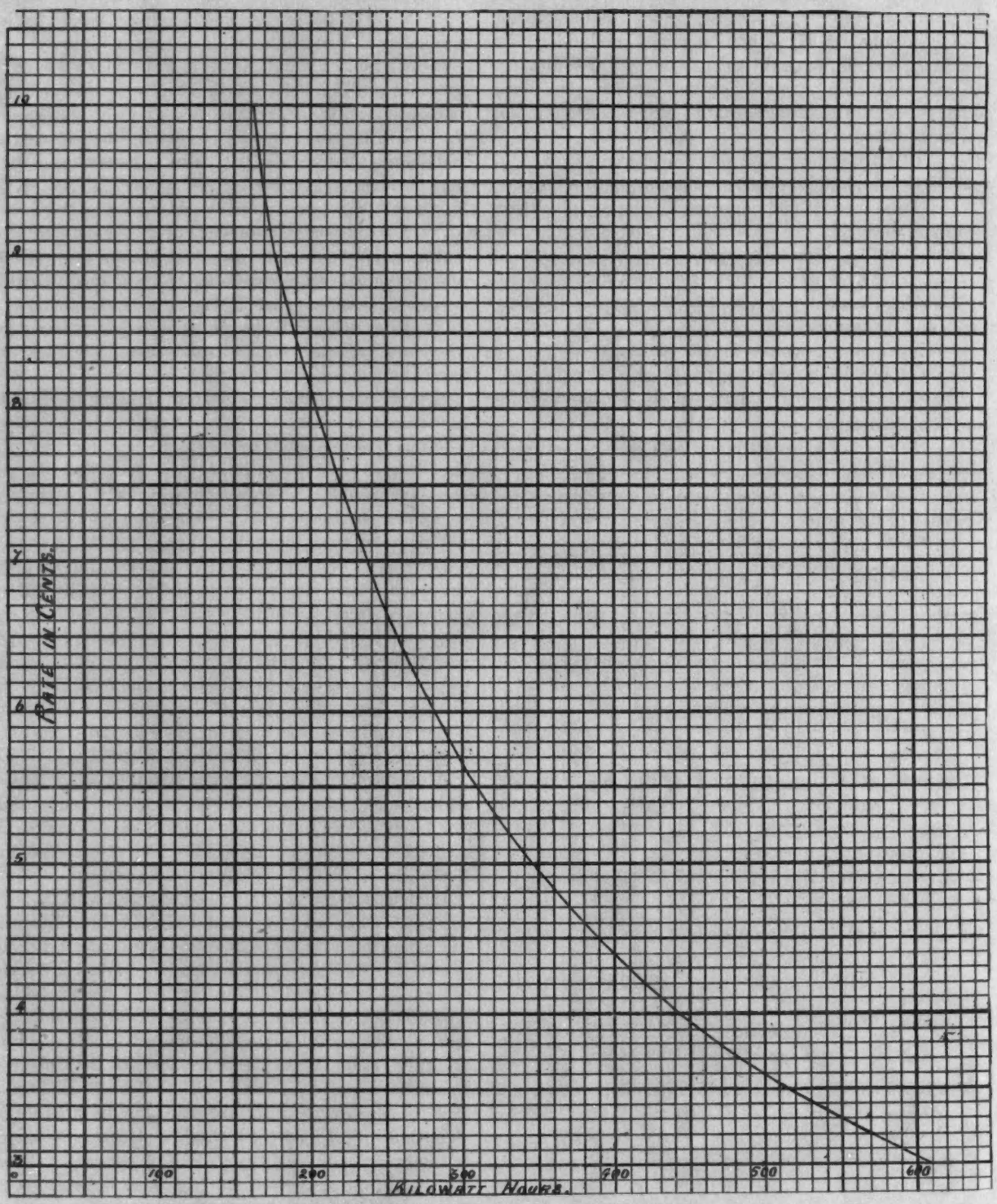

FIG. 2. RATE CURVE FOR CONSUMER HAVING 5 KILOWATT CAPACITY CONNECTED.

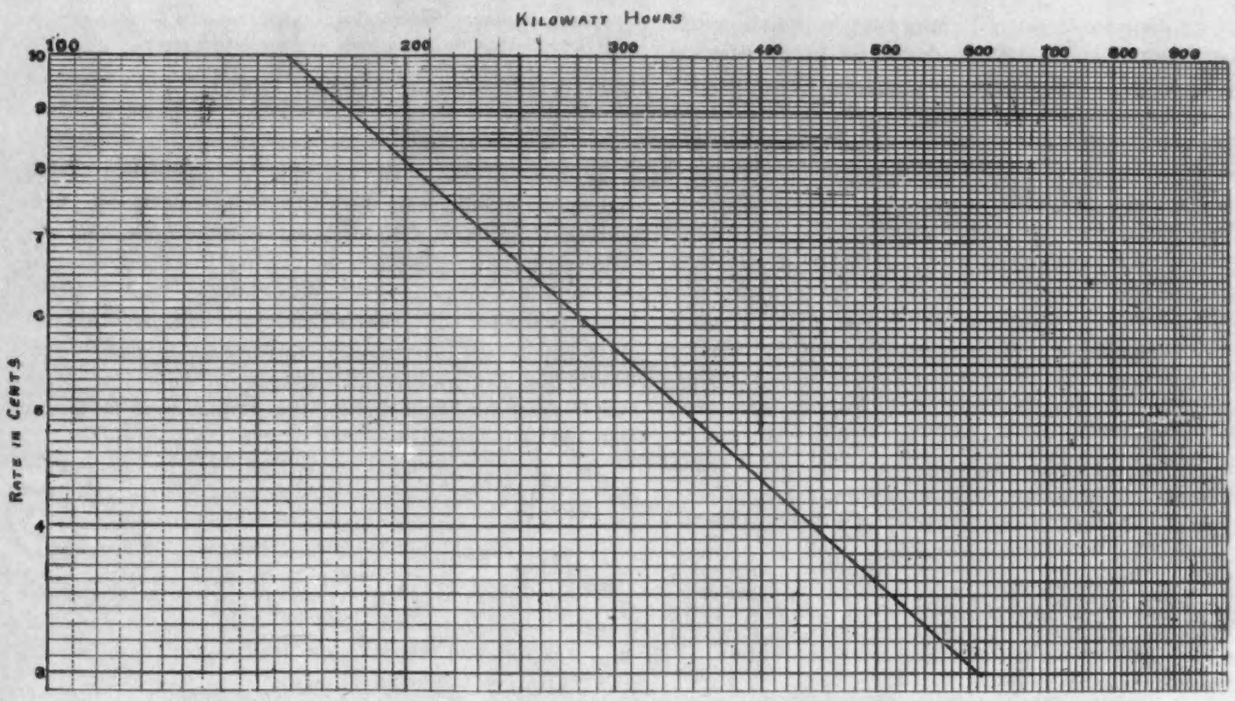

FIG. 3. RATE CURVE FOR CONSUMER HAVING 2 KILOWATT CAPACITY CONNECTED. PLOTTED ON LOGARITHMIC CROSS-SECTION PAPER.

system permits the establishment of rates that are equitable and just, both to the consumer and to the company. The system penalizes possible peak loads by making a gross charge for each kilowatt connected. It recognizes the value of large connected loads if there is adequate current consumption, and gives the small consumer a chance to get the low rate if his use is heavy in proportion to his possible maximum demand. It does not take cognizance of one important factor, viz, the portion of the twenty-four hours during which use is made of the current, and the time at which the peak occurs.

This, so far as I know, no system as yet proposed does take cognizance of, nor does it seem possible that any can do so that would not involve elaborate apparatus, and endless cost.

The system noted is not well adapted for the large heavy users with whom most of the transmission companies have contracts, but for the miscellaneous business of retail supply in cities and towns I believe it could be used to advantage.

TRANSMISSION OF POWER VERSUS SHIPMENT OF FUEL.*

BY A. J. BOWIE, JR.

IT has frequently been suggested that economy in transmission could be effected by the location of a power plant at the source of supply of fuel and by transmitting the power by electricity therefrom to the point of its consumption. So many elements enter into the problem that it is impossible to say, without an accurate knowledge of conditions, whether or not such a plan would be preferable to the shipment of fuel to the center of distribution, and the location of a generating station at that point.

Some time ago I had occasion to make figures on the relative values of the two plans for a large power transmission scheme, and the results of the figures are given further on.

The voltage which is selected for long distance transmission plays an important part in the economy of the same. The economic transmission voltage is dependant mainly on two things—the distance to which power is to be transmitted, and the amount of power to be used. The proper voltage to use is, in general, that at which a suitable balance is effected between the cost of wire on the one side, and the cost of insulators, transformers and switches on the other side.

In any large undertaking, there must also be considered the satisfactory operation of the plant when at least one transmission circuit is out of commission; under which conditions the generating plant should be able to deliver suitable pressure at the other end of the line. The allowable size of line wire, and the proper frequency to give sufficiently good regulation for the receiving end of the line are also of importance in fixing on the size and number of lines. It is not sufficient to figure merely on the possible economic loss of power in the lines to determine the size thereof.

Consider the case of the transmission of a large quantity of power from the center of fuel supply to the center of distribution, situated a long distance away. In general a suitable transmission voltage will necessitate raising transformers for the power house, and lowering transformers at the center of distribution, even though the power

*A paper presented to the Eighth Annual Convention of the Pacific Coast Electric Transmission Association, June 21-22, 1904.

is to be distributed several miles therefrom. Were the power station to be located at the center of distribution, power might be generated direct, without transformers, at a voltage suitable for distribution.

The plant on which I figured was to have a capacity of 9000 kilowatts in generators. It was to be erected in the oil fields, and to transmit power to a center of distribution 150 miles distant. The figures which I had made were only of a preliminary nature, and were as follows—not to enter details.

Total cost of steam and electric plant erected, complete without transformers, $684,000, or $76 per kilowatt.

Figuring on 7 per cent. interest, and 7 per cent. for depreciation, repairs, removals, and also on the necessary operating expenses, the cost of same per kilowatt-year, 100 per cent. power factor and 100 per cent. load factor was	$14.50
Cost of fuel oil at 15 cents per barrel, 43.3 barrels, per kilowatt-year	6.50
Total cost per kilowatt-year	$21.00

Assuming 75 per cent. load factor and 90 per cent. power factor, the cost per kilowatt-year is as follows:

Fuel (allowing for decreased efficiency)	$ 7.50
Fixed and operating expenses	21.50
Total	$29.00

These costs are for power delivered from the power house switch board. The transmission system was to consist of two pole lines, each of which would have one three-phase No. 000 aluminum power circuit and one telephone circuit.

There were to be forty, forty-foot poles per mile of pole line. Voltage of transmission 60,000, and the estimated cost of the transmission system is as follows:

Poles, set and armed	$ 96,000
Insulators	48,000
Line and telephone wire	246,000
Raising and lowering transformers	100,000
Transformers, substations and switches	15,000
Right of way	5,000
Total	$510,000

Annual expenses of operation and fixed charges of the pole lines would be as follows:

Interest 7 per cent. on $510,000	$ 35,700
Depreciation on poles 10 per cent. on $96,000	9,600
Depreciation on transformers 5 per cent. on $100,000	5,000
Depreciation on insulators 5 per cent. on $48,000	2,400
Depreciation on remainder of installation 2 per cent. on $261,000	5,220
Patrolling pole line, etc	4,080
Total	$62,000

The annual cost of the pole line, per kilowatt of power house installation is $6.90.

Hence the fixed charges and cost of operation per kilowatt-year for the power house and line is $21.40 for each kilowatt of generator installation.

With 100 per cent. power factor, the full load line loss is 10 per cent. Assume that 14 per cent. of power generated is lost in transformers and transmission line.

Allowing for these losses, the annual cost of power delivered is as follows:

Fixed charges and operating expenses $\frac{\$21.40}{.86}$ =	$24.90
Fuel	7.55
Total	$32.45

These figures are for 100 per cent. power factor and 100 per cent. load factor (case No. 1). Assuming 90 per cent. power factor, and 75 per cent load factor (case No 2.) the figures would be as follows:

Fixed and operating expenses	$37.00
Fuel	8.70
Total	$45.70

The costs for transmitting power are as follows:

Case No. 1	$11.45 per kilowatt-year
Case No. 2	16.70 per kilowatt-year

The fuel consumption per kilowatt-year for power delivered from switch board is as follows:

Case No. 1	43.3 barrels
Case No. 2	50.0 barrels

Hence the cost of transmitting power would be sufficient to offset an additional price for freight per barrel of oil between the power house and center of distribution of from 26 to 33 cents. The latter condition would be the safer one on which to figure. Hence with freight at 33 cents per barrel it would pay equally well to install the plant at the center of distribution, and to ship the oil thereto. Under those conditions it would certainly be preferable to put the plant at the latter point to avoid possibilities of a long line getting out of order, and to obtain better service. With a much larger plant, and a higher voltage, conditions might easily be changed.

ICE INTERFERENCE IN POWER DITCHES AT HIGH ALTITUDES.*

BY R. W. VAN NORDEN.

THE snow and ice interference in ditches and flumes at high altitudes does not make itself keenly felt until these ditches are to be used for supplying power service. This then becomes an important problem throughout the winter months.

The sudden climatic changes, over a wide range, that occur in the Sierras are responsible for many unlooked for pranks which seriously affect the ditch and flume systems. The principal cause of trouble is due to floating snow, which banks up the racks and screens, effectively cutting off the water supply. As a secondary source of interruption, anchor ice is encountered. Large sections of ice will freeze to the bottom of the ditch, started probably and assisted by the floating snow, and after accumulating a considerable bulk, so as to become buoyant, will rise to the surface and float. As the ice rises, after being freed, it carries with it good sized rocks, gravel, pine needles, leaves and sticks.

*A paper presented to the Eighth Annual Convention of the Pacific Coast Electric Transmission Association, June, 21-22, 1904.

Above the power house at Alta, where the reservoir during the winter months was not being used, the water from the ditch is poured directly into the forebay, falling with considerable force. After striking against a baffle wall to break the momentum of the stream, it passes through a screen from whence it enters the pipe line. After leaving the screen the water is comparatively quiet.

The effect of the snow is to jam against the screens and then freeze hard. Anchor ice will pile on top of this barrier and the gravel and debris will fall only to be carried underneath by the flow. Aside from very effectually shutting off the water supply, the gravel and sand go down the pipe line, with the attendant annoyance to valves, etc. This operation takes place not only at the forebay, but along the ditch line, causing more or less uneven flow. Sand boxes and frequent spillways, are a partial remedy, but are not absolute, as much of the floating material is not at the surface.

Snowslides aggravate and make the interruptions very uncertaion incidents to prevent. Aside from this their effect is often curious, which the following example will show.

Recently a heavy slide, completely blockading the canal, caused an overflow and finally a bad break in the ditch wall. Although a gang of men were near at hand to provide immediate relief for such an emergency it was several hours before a flume could be built and the ditch closed. During this work a heavy snowstorm came up, effectually burying the now empty ditch. The ditch was so completely buried in places that one could scarcely determine its location. It was necessary to dig a considerable channel in the ditch before it was possible to pass the water along, and this caused several hours delay.

Floating snow and anchor ice can be handled and gotten rid of, if in not too large quantities, by properly constructed waste wiers or easements and by frequent screens made of one and one-half inch by four inch timber. These screens are set up edgewise, and on a slant having a small angle with the horizontal cut. With every mechanical precaution, a large number of attendants is necessary to constantly patrol exposed sections. This menace at the fore-bay is only prevented by constantly raking the screens and the introduction behind the bar screens of woven wire to prevent the passage of fine particles.

POSSIBILITIES OF SINGLE-PHASE CURRENTS IN ELECTRIC POWER TRANSMISSION.*

BY H. A. BULLARD AND SIDNEY SPROUT.

THE old saying, "Be not the first by whom the new is tried nor yet the last to lay the old aside," represents a conservative idea well to follow out, and in this article we shall propose something not altogether new for trial, nor yet the laying aside of much that is old.

Single-phase was first in the attempts to make alternating currents commercial, and the exploiting of multiphase was the result of the development of a satisfactory multiphase motor which came forward much in advance of the successful single-phase motor. That the single-phase motor is now practicable, and that there is no limit to the sizes in which it can be built, seems to eliminate at least the oldest objection to the use of single-phase, and we propose to show that practically the only claim which multiphase has upon the consideration of engineers is the large amount of such apparatus in use.

As to the quantity of multiphase apparatus now in use, this article has little to do, except as we may hereafter show that many multiphase lines may be considerably increased in working capacity by the adoption of single-phase in the manner suggested.

A prime consideration in determining the character of plant to be installed for the electrical transmission of power is efficiency in its broadest sense, namely, economy in first cost, economy in operation, and economy in transmission. We propose to show that a single-phase plant for the purpose of generating, transmitting and distributing a given amount of energy may be installed cheaper than a multiphase plant under the same general conditions, and that economy will be found in operating expenses in favor of single-phase. Having shown this, of course certain deductions follow, namely, with same cost and same loss we have greater capacity; with same loss and same capacity we have less cost; with same capacity and same cost we have less loss. We recognize that these are broad possibilities to suggest.

"Long distance high potential electric transmission of power" is more or less indefinite, and for the purpose of this article we shall draw a line by the following rule, namely, anything shall be considered wherein the distance is considerable and the amount of energy to be transmitted, coupled with the voltage determined upon and the allowable loss in transmission determines a size of wire appreciably larger than that actually required to carry the current in amperes over a short distance under conditions where the line loss in any event would be negligible. To make this more clear we would state that there is probably not a long distance high potential transmission line in operation to-day where the size of the wire selected was determined only for conducting the amperes, but was made much larger in order that the allowable line loss should come within the range dictated by commercial conditions.

We take up the various parts of a plant in order, excepting line construction, which, being the most important, will be the last discussed.

1. Prime Movers—It is obvious that water wheels, and steam or gas engines, or other prime movers, would be the same regardless of the number of phases adopted, and the efficiency of the prime mover plant would be in no wise affected on their account.

2. Foundations, Buildings, etc.—Weights and dimensions of all apparatus would be much the same, regardless of the number of phases, and no material gain or loss would become apparent in foundations and buildings

*A paper presented to the Eighth Annual Convention of the Pacific Coast Electric Transmission Association, June 21-22, 1904.

except wherein single phase, by simplifying the arrangements, might simplify the construction of the buildings, such as power house and substations.

3. Dynamos or Generators—Dynamos of modern and accepted construction, and of any make, have a smaller capacity single-phase than when the same frame is arranged for multiphase, the theoretical difference being as 58 is to 100. However, in actual conditions of operation the range is from 60 per cent. in small generators to 80 per cent. in large generators. The price of single-phase generators is usually about 5 per cent. less than for the same frame multiphase, hence the price per kilowatt is greater for single-phase, ranging from 58 per cent. greater in small machines to 32 per cent. greater in large generators. As we are dealing with large units of power we can assume that single-phase generators of the required capacity will cost 32 per cent. more than multiphase generators to do the same work; but all know that the actual money invested in generators is a very small item in the entire cost of equipment, and in the light of the savings we expect to show throughout the rest of the equipment this extra cost sinks into insignificance.

Generally the line voltage required will demand step-up transformers, which takes us out of the range of possible high initial electromotive forces on the generator windings themselves, and an objection to the use of single-phase generators which may come to the minds of some is thus eliminated. We refer to the advantages of star and delta connections. A 15,000-volt initial generator potential three-phase may be obtained by an 8070-volt winding connected in "star," whereas the same potential single-phase would require a 15,000-volt winding. This, however, is only an apparent advantage, since both machines should be insulated for 15,000-volt conditions, and this insulation is the real expense, or source of trouble, as the case may be.

4. Switchboards—In the usual modern and accepted switchboards, complete in every detail, we find a condition favoring single-phase in first cost, simplicity, and, because of this simplicity, a great economy in operation. It must be admitted that the average station attendant will more readily comprehend single-phase conditions than the complicated conditions often incident to three-phase, and one matter alone, called to attention, will suffice to illustrate, namely, the synchronizing of generators, or stations, wherein, with three-phase, great care must be exercised that the relation between phases is always correct.

The current for single-phase is always greater than for multiphase, all other conditions being equal, and this adds to the capacity required in switches, instruments and wiring; but this is an added cost per leg only, and the fact that single-phase requires but two legs, against three or four, represents an actual saving of far more than the extra cost for copper. The one ammeter of large capacity costs less than the two or three ammeters of smaller capacit and the same idea applies equally well to wattmeters, main and feeder switches and automatic protective devices. The number of voltmeter transformers will be less, and the labor item of erecting and wiring the board will represent a considerable saving. A single-phase switchboard for any given conditions will cost about 25 per cent. less than a three-phase board for the same work. Economy of space is also gained, and this is often of some importance.

5. Station Wiring—While it is admitted that the cost of copper for a single-phase station will be 33⅓ per cent. more than for three-phase, on a strictly theoretical basis, yet it is a fact that in actual practice it will seldom be found more than 15 per cent. greater, and this is more than offset by the saving in labor required to wire the station for single-phase, which saving will be 33⅓ per cent. in every case. Here the matter of extreme simplicity becomes of great importance.

6. Step-Up and Step-Down Transformers—There seems to be practically no limit to the size of power transformers which the manufacturers are willing to build, and the price per kilowatt, other conditions being equal, is reduced somewhat as the size is increased; hence it is obvious that one large transformer will be cheaper in the first cost than three smaller transformers which combined will give the same total capacity. However, this saving is so slight as to be negligible, and doubtless the more important consideration would be the selection of the total capacity in transformers subdivided into such number and size of units as would assure practically uninterrupted service. It is safe to say that in the adoption of single-phase the cost of step-up and step-down transformers would not in any wise be increased, but could be somewhat decreased.

7. Distributing or Lighting and Motor Transformers—For lighting and motor transformers there is quite a saving in price for the one large transformer, single-phase, against the three smaller transformers aggregating the same capacity three-phase. The difference will vary from 50 per cent. in very small units to 15 per cent. in the largest lighting and motor transformers.

8. Lighting Arresters—In connection with lighting arresters and kindred apparatus, it is merely necessary to point out that only one-half of the multiphase equipment is required for single-phase; hence one-half of the first cost and one-half of the troubles which sometimes occur in connection with the use of lighting arresters, static interrupters and apparatus of like nature.

9. Rotary Converters—The rotary converter will undoubtedly be eventually eliminated, since its primary purpose is the conversion of alternating current to the uses of direct current railway service. However, in cases where a rotary converter must be used, a single-phase rotary will be found quite as cheap and satisfactory as a multiphase rotary.

10. Lamps for Lighting—All kinds of lamps are essentially single-phase; hence nothing is to be gained or lost in this respect except in so far as single-phase distribution for such purposes would be found simpler than multiphase.

11. Synchronous Motors—Single-phase synchronous motors will be found quite as satisfactory in operation as

multiphase synchronous motors; but it is true their cost will be increased. The cost, however, is borne by the consumer and it is probable would never assume the proportions of a serious item in any case.

12. Induction Motors—As pointed out in the beginning, the single-phase motor is a commercial product, and the instant that the demand is created they will be supplied in any sizes required and the present limit to small sizes eliminated. It is not the purpose of this article to discuss the relative merits of single or multiphase motors, but suffice it to say that the first cost is approximately the same, the efficiency approximately the same, and the single-phase motor more closely resembles the characteristics of the direct current motor in its diversity of application than does the multiphase—wherever a multiphase motor will do the work required a single-phase motor will do it equally well.

13. Street Railway Motors—In connection with street railway motors, it is merely necessary to point out that practically all the efforts being put forward to the end that alternating current railway work may become commercially successful point to the adoption of single-phase motors as the motive power, and if a three-phase plant be used to supply an alternating current railway, the phases will have to be separated before the current can be used on the cars; that this will prove complicated as compared to a straight single-phase system, no one can fail to appreciate.

14. Line Construction—The transmission line is of extreme importance, and there are three different constructions which can be used, namely, plan No. 1, a complete metallic circuit consisting of two wires strung overhead; plan No. 2, one single wire overhead and a return circuit obtained by another wire not strung on the poles, but buried in the ground in any convenient location along the right of way; plan No. 3, one single overhead wire and a ground return, the latter accomplished by sinking more or less deep shafts in the nature of artesian wells at all generating and substations, and thereby obtaining the necessary ground return.

Before going further we wish to give a few figures adopted for the purposes of this article, some being averages of results available and attained on certain Pacific Coast transmission lines.

Average cost per cross-arm	$ .75
Average cost per pole set in place	8.50
Average cost per insulators	1.25
Average cost per wooden pin	.15
Maximum cost per iron pin	.40
Average for stringing three overhead wires per mile	40.00
Average for stringing two overhead wires per mile	34.00
Average for stringing one overhead wire per mile	20.00
Average for stringing one overhead wire and one underground wire per mile	27.50

The usual triangulation of the three wires of a three-phase circuit necessitates from three to five feet greater length of pole than would be required if all wires were in the same plane, and hence the wires of a single-phase circuit could be kept the allowable distance above ground with greater sag, or shorter poles, or greater distance between poles, and the latter arrangement we have adopted, since there is no danger of the two wires swinging together. The use of metal pins with the present strong insulators give substantial construction with ample factor of safety.

The usual practice of forty poles to the mile gives spans of 132 feet each, and with single-phase there will be no trouble in keeping the wires the allowable distance above the ground with spans of 250 feet, or twenty-two poles per mile.

The following table gives the cost per mile for each of the various types of single-phase line construction, compared with the cost of three-phase three-wire, the copper item being purposely omitted. We have assumed a $5000 00 artesian well for ground in every fifty miles of line as a fair average, and believe we are well on the safe side.

COMPARATIVE COST OF LINES PER MILE EXCLUSIVE OF COPPER.

Item	Three-Phase Three-Wire		No. 1 Single-Phase Two-Wire Overhead		No. 2 Single-Phase One Overhead and One Underground Wire		No. 3 Single-Phase One Overhead Only	
	No.	Cost	No.	Cost	No.	Cost	No.	Cost
Well for Ground							One to Every Fifty Miles	$100.00
Poles	40	$340.00	22	$187.00	22	$187.00	22	187.00
Cross-arms	40	30.00	22	16.50				
Insulators	120	150.00	44	55.00	22	27.50	22	27.50
Pins	120	18.00	44	17.60	22	8.80	22	8.80
Labor		40.00		34.00		27.50		20.00
Total		$578 00		$310.10		$250.80		$343.30

Taking single-phase, two-wire, as requiring 100 per cent. of copper, the three-phase, three-wire, would require 75 per cent. and the single-phase, with one overhead and one underground wire, would require 100 per cent. assuming no value for any actual ground return there might be. Further, assuming the artesian well ground return to have a resistance equal to that of the overhead wire (it would probably be less however) the single-phase, with one overhead wire only, would require 50 per cent. of copper. Taking the table, these figures and copper at 18 cents per pound, the following is readily deduced.

Two hundred and sixty-seven dollars and ninety cents, the difference between three-phase and single-phase, (plan No. 1) would purchase 1488 pounds of copper, which is the extra copper that could be put into the single-phase before that line would equal in cost the three-phase for same loss and load. Hence, a three-phase line requiring three wires, each 93,200 circular mils in area, would cost installed, the same as a single-phase line (as per plan No. 1) requiring two wires, each 186,400 circular mils in area. Hence, two-wire, single-phase (as per plan No. 1) is cheaper than three-wire, three-phase, whenever the three-phase line requires a size of wire smaller than No. 1, or when the single-phase requires a size of wire smaller than No. 000.

Three hundred and twenty-seven dollars and twenty cents, the difference between three-phase and single-

phase (plan No. 2) would purchase 1818 pounds of copper; hence a three-phase line requiring three wires, each 114,000 circular mils in area, would cost, installed, the same as a single-phase line (as per plan No. 2) requiring two wires, each 228,000 circular mils in area. Hence, two-wire, single-phase (as per plan No. 2) is cheaper than three-wire, three-phase, whenever the three-phase line requires a size of wire smaller than No. 0, or when the single-phase requires a size of wire smaller than No. 0000.

Since single-phase (plan No. 3) requires only two-thirds of the copper required for three-phase, it is at once obvious that there is no possible condition wherein three-phase could ever become as cheap as single-phase (plan No. 3).

It is easy to conclude that single-phase, with one overhead wire, is the cheapest, and that the return circuit should be obtained by either plan No. 2 or 3, or a combination of both.

Having shown that single-phase may be cheaper than multiphase for transmission purposes, we want to point out some possibilities, as follows:

The feature of the grounded return would not increase the cost of insulators, as might at first seem likely, for an ideal condition is obtained, namely, a single insulator on the top of a single long pin—the pole. Nor would it increase the cost of insulating the main step-up and step-down transformers, since this very ground would be their protection by eliminating practically all sources of insulation break down.

All static accumulations on the line would be done away with, and the effects of capacity, reactance, inductance, etc., would seem to be neutralized or utilized as the case may be, and to an extent eliminating many of our present troubles on three-phase lines; 120 insulators should give about three times the trouble that 44 would, and one wire would certainly cause much less trouble than three—bad boys, accidents, and the elements considered. Distributing or lighting and motor transformers would not necessarily have one side grounded, though it might be wise to connect one leg to the grounded leg of main step-down transformers.

Present three-phase lines can be left as they are and used for single-phase and the capacity of the line increased as, for instance, by sinking artesian wells and thus making a ground. The three-phase generators would give 80 per cent. of their capacity on any one phase alone, and the capacity of the line would be increased by 50 per cent., this of course would call for an addition to the generator capacity of 62½ per cent.

The various advantages in favor of single-phase, as brought out in the above, would seem to be worthy of the careful consideration of this Association, and we hope for an earnest and thorough discussion.

ON SECURING SAFETY IN THE USE OF TELEPHONES.*

BY H. G. AYLSWORTH.

I HAVE been asked to read a paper on telephony as applied to high-tension power lines. In regard to line construction, transposition, etc., my experience has only been in standard exchange work, and I should first prefer to hear from those who have had more experience than myself along the lines of transmission practice. I think, however, that the following description of a new type of instrument for high-tension work will prove interesting, as it embodies several new ideas. R. W. Van Norden originally submitted these specifications, some time ago, to one of the leading telephone manufacturers and I believe has now installed the instruments that were built under them.

The telephone proper is of the ordinary dry battery wall type, with the exception of not being equipped with ringer coils. The principal feature of the set is the induction coil. This is of the repeating coil type provided with three windings. The primary winding, which is connected to the line through a contact in the switch-hook and a tertiary winding, which is connected directly with the receiver. The secondary winding, which is in series with the line, is No. 24 copper wire, insulated with double silk and single cotton insulation. These windings are insulated from each other by hard sheet rubber. The whole of the coil is inclosed in a brass case having hard rubber ends, one end bearing the binding posts of the secondary winding and the other end bearing the binding posts of the primary and tertiary windings. The case is filled with ordinary transformer oil. This is to prevent the insulation being punctured by either static discharge or an accidental cross of the telephone wires with the transmission wires.

The receiver is entirely covered with a hard rubber shell, so that no metal is exposed. Having the receiver in a local circuit lessens the possibility of burning out of the receiver coils, and by immersing the induction coils in oil the liability of having coils destroyed is also greatly lessened.

The transmitter is of the new solid back type, using granulated carbon between gold gauze electrodes. All exposed metal parts of the transmitter, as well as the telephone, are insulated from the telephone circuit. The switch-hook is of the ringing key type, very substantially made with German silver springs and pure platinum contacts. The hook proper forms no part of the circuit. A special crank which insulates the generator crank thoroughly from the generator itself. The line terminals are inside of the telephone box, so that there is nothing on the outside of the box which forms part of the circuit.

The lightning arrester consists of three carbon blocks, each measuring about one and one-half by one and three-quarters by one-quarter inches. The two outside blocks are connected to the line and the center block connected to the ground. These blocks are separated by a thin sheet of mica and have been known to ground a line

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which was crossed with a 110-volt lighting circuit. This adjustment is too close, however, for ordinary work.

There is also a pair of three-ampere tubular line fuses provided, as well as heat coils, which are wound to a resistance of about seven ohms, and arranged to operate on from three-tenths to four-tenths of an ampere. It is not claimed that this fuse will absolutely protect a telephone circuit against 30,000 or 40,000 volts, but there is no doubt that it will protect it against all ordinary crosses and grounds.

For signalling, either an ordinary extension bell, which is bridged on the line in the customary manner, or in localities where it is desirable, a large six-inch gong extension bell can be used. It would also be desirable to put a small one-quarter-ampere fuse on the circuit leading to the bell, as a further protection.

Members of the Association will probably be interested in the outcome of this system being installed by Mr. Van Norden.

SOME EXPERIENCES OF A SALESMAN.*

BY H. A. RUSSELL.

THE principal object of any kind of a convention paper is to bring out points that will start a discussion. It is in the discussion that the real truth is arrived at and original ideas developed. But a salesman is not a technical subject and this paper is merely supposed to give some experiences of the salesman. There is no need of discussing him—this is done continually by those he deals with, and I am afraid "discussing" is often applied to him by dropping the prefix. He is the buffet to take the blame whenever and wherever anything goes wrong. That is what he is for, if he has any real excuse for existence. For he neither makes the apparatus nor uses it, but goes around inducing somebody to use it so that somebody else may market it. He may be an evil but he is necessary, for business cannot be done without an agent—a go-between. We cannot go into the orange groves and buy oranges as well as we can place our order with an agent, who in turn deals with the grower. There is a fertilizer concern in Chicago that manufactures its goods from bones and other stock obtained from a packing house adjoining it. That seems neighborly and as though they ought to do business together without an intermediary, but when they buy this stock they wire their agent in New York who makes the deal, orders are wired back and the material is wheeled across the alley to the purchaser. It would seem like an agent in this case were superfluous but I guess he is necessary. And so if we could have the engineer or the superintendent sell what he designs or makes we might do away with the salesman, but he is not to be killed off that way. You may call him names and use him for a punching bag to vent your spite on when anything goes wrong, but the truth is you love him and could not do without him.

"Experiences of a salesman" is not a happy title, for it would be a sort of continued, hard luck story. I divide his experiences into five kinds of worry.

First to get the order. This is the real race with excitement in it. Like a derby candidate he may never get entered, or he may fail to meet specifications and get left at the post, but it is usually work and worry to get the order. If he is beaten he may be fortunate in escaping the troubles that follow. Experiences of this variety of worry are so numerous and varied that if we stop to talk of them we would never get off the subject. We wish to know of the other phases of the work that only appear to the man that is in the fight.

Second, having his contract signed he must obtain his principal's acceptance. That is easy, isn't it? I have a case in mind where after a great deal of hard fighting a contract was signed and passed up to headquarters. The builders did not approve of the combination of engine and generator that had been made, and passed back the contract for revision. Revision meant that the builder must have more money to do the work, or less work must be done to suit the price obtained. The agent did not feel well—he had a relapse. He was obliged to fight his battle out again with the result that his business was cut in half—the engine part of it getting away from him. Sometimes a contract is signed but the buyer must obtain an approval from some of his associates. A case of this kind came up about two years ago where an engineer had to go through the form of putting his name on the document. It was a public contract, with advertised bids, certified checks and all such refined trimmings and had been won after a hard fight. The consulting man—the "insulting engineer"—said: "If I am your consulting engineer, give me the papers before awarding the contract, not after. If you wish to sign contracts, go ahead, but leave me out." Up to the present writing he has not made his O. K., and the contract, though awarded, will never be executed. Another stumbling block is the credit approval. A certain credit man that is good to me—he pays me my salary—advises that we learn all we can about a prospective customer beforehand, so that his credit can be approved without delay after the contract is signed. I hope none of my worthy opponents are superstitious, but I admit that I am. Whenever I have adopted this method and found my man to be A 1. I have lost the order. It is a hoodoo. There is much peace of mind, if not wisdom, in not crossing the bridge until you get to it. So get the order first, and after a man has signed a contract and you begin to question him about the wherewith, the chances are that it is his turn to worry.

Worry number three—shipment. As soon as a contract is signed the buyer thinks that is the only order you ought to bother your head about, and he does not understand why every other one is not sidetracked to give his preference. He wants it shipped in thirty days, and you compromise with him and finally agree to ship in ninety days after the contract is signed. He delays this little

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formality for ninety days—long enough to build the apparatus—then signs the contract and his hurry begins. You know that many other things must be done before he can use your machinery—a pipe line must be put in, a building must be erected, etc., etc., but you cannot make him see all this, and you must give him half-hour bulletins of the progress of that order or else keep on the other side of the street when you see him coming. Here is an instance of such a case. Four months was the time the factory needed to get out a certain order. Impossible—eight weeks was the purchaser's limit; our factory friends strained a point—probably their conscience too—and probably strained some of the commandments, if they did not break them. They accepted the eight weeks proposition, and by robbing Peter and fudging a little on the time, actually made shipment in twelve weeks. That was pretty serious, wasn't it?—to overrun the time fifty per cent. Well, not noticeably so, for the machinery laid on the ground unhoused and exposed for six months before it was erected. After a few such experiences as that is it to be wondered at that a salesman will make any old promise and then live up to it by making any old shipment? A friend whom many of us know once classified the prevaricators as the liar, the d—n liar, and the electrical engineer. I know he meant the salesman, for he himself was a charitable man and an electrical engineer. As for truthfulness, I wonder what kind of dynamos George Washington sold in his early youth, or what kind of buyer he ran up against. If one had told him his price was high or his shipments too long, when he knew the facts were to the contrary, he would have put in some sort of a hatchet story and saved the day I am sure. Some buyers demand what they do not need and cannot get, and a sensible salesman ladles out the promise he wants. He takes liberties with a promise of shipment that he would not take with other features of the contract because there is no pecuniary liability involved. I knew one salesman, recently, who was very anxious to get an order where "time was the essence." He promised to ship in sixty days, or "thirty if I get the order." There is a promise made while you wait that ought to satisfy the most exacting buyer, and it has a premium feature about it too.

Worry number four. The contract is signed, approved and shipped. Now we must get it accepted. This may be done by a man who has had nothing to do with the former part of the work, and it may be fortunate for the salesman if it is not. In his eagerness to sell he may have made verbal boasts and promises that were better forgotten about acceptance time. You explain how little care this machine needs and its regulation is so close that it almost anticipates thought, and some people are very agreeable about remembering such things. Or worse still, they may have been disagreeable enough to have inserted these beautiful features in the contract. I recall one municipal plant where the selling was very hard; the approval was easy because the company wanted to get in an initial machine, and were ready to accept any old condition to make the start; shipment was easy, I think they took experimental machines out of the testing room; but the acceptance made some people wish that contract had never been signed. The apparatus worked well—if you didn't let it run too long, or change the board too often, or get too far away from it. The municipal board were about convinced that they could not get rid of the machines and the agents both at once, and thought best to accept the machines and get rid of the agent, the expert and a few other pests. About this time there was an election, resulting in a new board, and a new city electrician. The work had to be done all over again. The electrician himself was a good single hand talker, and was determined to show that board that he knew his business fore and aft. Well he did know it, but the agent never let the board know that he knew it, and finally won out, and the machinery was accepted. Those machines served a purpose. They are prominent and alone in the history of electric lighting in California. They have served their time and have now given way to their betters.

Trouble number five—Payment. Your troubles are not over, and you cannot close the chapter until the last payment is in. It might seem that all of this is not the salesman's work, that much of it should devolve upon the engineer, the credit man, cashier or others. Well, it does, if everything goes on smoothly as the salesman plans and hopes. But let trouble appear above the surface, and at once the salesman is the Poo Bah governing that contract. He creates it and must see it through. Like the politician, he is also looking for another term. If he allows the principals to bear down too hard on the customer it might effect future business in a way pleasing to his competitor.

So the salesman, while he is the life of the business, he is the scape goat for all its troubles, and we usually find him capable of carrying his cross.

A sale which I recall as being most unique and interesting, was when a street car contract was let some years ago. There were two competitors after it, and as about the only specification that the buyer had imposed upon them was for *very powerful motors*, the rival bidders used their judgment in making up a list of generators, motors and trimmings that certainly looked good to him, and was calculated to win the old man without argument.

Saturday afternoon all figures were in, but Saturday until Monday is a long time for a judge to withhold sentence, so the old man—as we may call him—was accorded a visit from the salesman on Sunday afternoon, wishing to know his fate. "Well, my son," he he said, "I am very sorry, but I have figured it all out and have decided to give your opponent the order, as he has the lowest figure. Here is his proposition, and here are my calcula, tions. I will go into the garden, leave you undisturbed-and if you can show me where I have erred, and you are one cent lower than he, I will give you the contract, but I will not let you alter your prices." For half an hour the salesman figured fast and furious, trying to make figures lie. But the old man's mathematics was as faultless as his decision was fair. The crestfallen salesman

was compelled to acknowledge defeat, and retired in good order after caring for the dead and wounded—dead hopes and wounded pride. Next morning, Monday, bright and early, the salesman was sent for and ushered into the old man's private office. "I haven't treated you nicely, have I? Well, I have decided to give you a contract too, but nobody must know about it but you and me. Promise me that you will not let it be known in your office, but wire the order direct to your Eastern manager. Have it routed as I direct, shipped to you personally, and stored on arrival. I will pay your price—is it a bargain?" Here was thunder out of a clear sky. His franchise would lapse in a short time and delay in shipment, or after shipment, which he thought the "Octopus," his sworn enemy, was capable of purposely bringing about, might ruin him. His first contract was open, the second sent so that if one failed he would have the other. The first order came as planned, likewise the second and was duly stored. But the Eastern office did not carry out their injunctions to the letter. They sent out a bill which fell into the secretary's hands, who turned it over to the superintendent for explanations. He in turn saw the salesman who had been whipped in open battle and asked him if he didn't know when he was licked, and what was the meaning of such a bill. The all-suffering agent took the abuse, acknowledged that he was various and sundry kinds of fool, and promised an official appology from his home office. He saw the old man on the quiet, however, and in the course of time secrecy was no longer desired, everything was explained, and the agent had the last laugh.

I refrain from personalities, but that is the road that has done the poor workingman more injury than any other corporation or trust in San Francisco. Before it was built a man could walk out to the beach and save ten cents by doing so. Now he only saves five.

MEDIUM-SPAN LINE CONSTRUCTION.*

BY CLEM A. COPELAND.

DISTRIBUTION engineering is a new and distinct branch of the electrical profession, and involves the design and construction of long distance or cross-county transmission lines and city distributing systems for all electrical industries. It is a fertile field for the electrical engineer, because the present state of the art is so exceptionally crude.

To thoroughly appreciate this, let one write a bibliography of references in this branch of engineering. It will be found that in the suprisingly few instances, mostly in Europe, where study and skill have been expended on distributing systems and lines, the description of them is a little more than an aggravation in its briefness and unsatisfactory allusions to a deserving subject.

It has been the chief desire of companies to get to the customer with some sort of a line and obtain a swift revenue, while the engineer has not considered it worth his while to spend more than a wisp of his time on line work. The result has been that more than seventy-five per cent. of the troubles experienced in the distribution of power, both as to number and cost, have occurred outside the central and substations. The major part of the cost of these troubles has been due to lack of confidence in electricity as a power fund and convenience which does not always show on the books. These remarks apply as well to telephone and telegraph lines and distributing systems as those for light and power.

Not only have lines been excessively troublesome, but they have cost too much. With a view to eliminating both of these faults on cross-country lines The Edison Electric Company of Los Angeles has been experimenting on several special methods of distributing system design. The one immediately concerned may be termed medium-span cross-country construction.

The ordinary length of spans, say from 120 to 140 feet, which have been used for the lines, have evidently been transplanted from early days and from localities where snow and ice load down wires to their breaking point even with hundred-foot spans. The conditions obtaining around a newly contemplated line should be as carefully studied as those surrounding the hydraulic and central station installations. Transplanting engineering may not always thrive in new soil.

The conditions encountered in the valley districts of Southern California are:

1. No snow and ice.
2. A temperature ranging for 20 degrees Farhenheit at night in winter to 140 degrees in the sun in the summer. (That is, a wire will become that hot.)
3. Occasional severe dry north summer winds which blow hay and mustard stalks upon the lines.
4. Frequent interference with lines by wild cats, buzzards, sandhill cranes, mudhens and owls—especially the may and June owls.
5. Numerous and almost unavoidable hedges of eucalyptus trees from 50 to 150 feet tall, which, with the assistance of winds, shed twigs and long shreds of bark onto the lines.
6. Rapid decay of poles, some rotting off in four years, while the average life is eight.
7. High cost of poles, the cheapest being cedar, and in thirty-five and forty-foot lengths costing from $5 to $10 in the yard.

Experience with bare aluminum cable suggested to the writer that stranded copper cables might be used in long span construction. and it was proposed to take good stocky forty-foot cedar poles, space them 225 feet apart, space the wires forty-five inches apart, and employ a sag of from fifteen to twenty-four inches, depending on the installation temperature. It was designed that a three-phase construction for a voltage as high as 40,000 with one or two circuits of Nos. 3, 4, 5, and 6 cable with single cross-arms, and Nos. 0, 1, and 2 with double cross-arms, should be used.

*A paper presented to the Eighth Annual Convention of the Pacific Coast Electric Transmission Association, June 21-22, 1904.

ONE OF THE GUANAJUATO FITY-FOOT POLES ESPECIALLY ADAPTED FOR WINDMILL WORK AS COMPARED WITH AN ORDINARY POLE.

The longest continuous long span work previously employed was in Europe on the Paderno-Milan transmission, with solid No. 1 wire and in which steel lattice work poles were spaced 190 feet. In the light of subsequent experience it would seem that if stranded wire had been used the poles could have been made a little heavier and taller and spaced twice as far apart. On the Vizzola-Ticzno-Milan transmission, also, steel latticed poles about the same distance apart had been used.

These ideas were received with temerity. It was argued that in case a wire broke so and so would happen; but if stranded and carefully installed they will not break. It was also argued that in case the poles rotted the line would be weakened more than if the poles were nearer together. But it would seem that a line should be kept in good repair, whether the poles were many or few, either by letting down five feet or stubbing. An engineer would not buy a boiler with more tubes in it than necessary and let them get in poor repair because there were enough tubes left to keep the boiler safe.

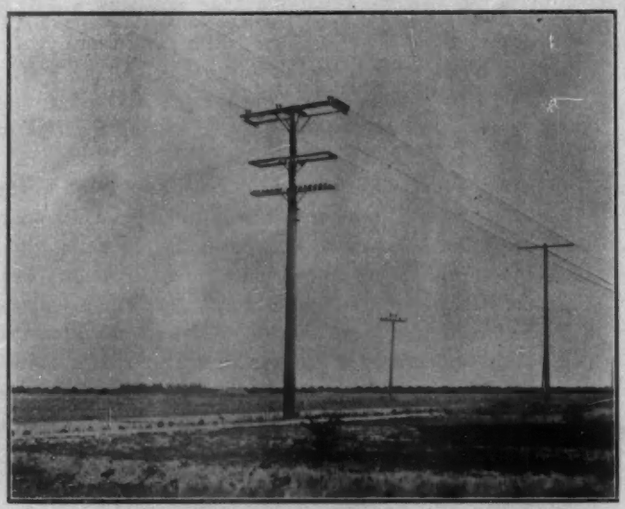
It was argued that in case the top of a pole burned off at the brace, as sometimes happens on the 30,000-volt line, No. 6 wire would not support the weight on a 450-foot span. Accordingly two experimental spans of 250 feet were constructed and strung with bare *solid* "second-hand" medium hard drawn copper, and while it is not necessary to go into great detail in regard to this test, it is sufficient to say that it was amazing the abuse these wires stood before breaking. No. 6 aluminum cable was also tested, and stretched so far before breaking that it also deserves much respect. The stretching factor of safety of copper wire is scarcely appreciated by engineers, and after these tests the writer very nearly recommended solid wire for 225-foot spans. In fact, by referring to the June number of the *Engineering Magazine*, 1903, we find a description of a European steel pole line which evidently employs 246-foot spans with solid No. 2 and 00 wires on forty-foot poles. This is in connection with the thirty-eight-mile transmission from Cenischia, Italy.

The writer knows of no case where a good solid medium hard drawn wire has broken without a good apparent

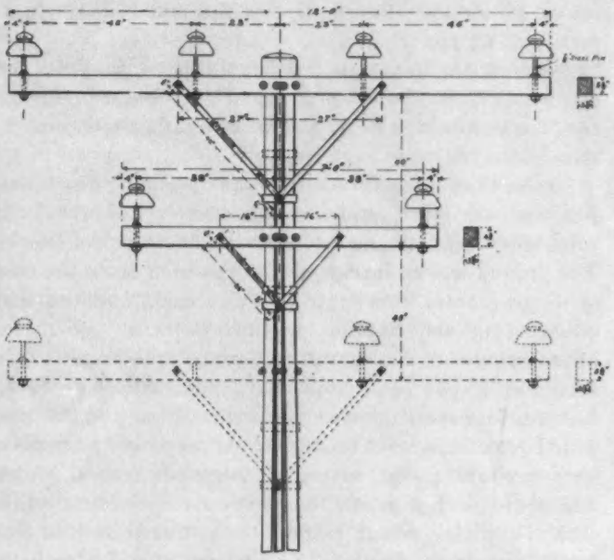
A TRANSPOSITION ON 225-FOOT SPAN WORK. ONE 10,000-VOLT CIRCUIT PREPARED FOR TWO.

excuse, such as a burn-off. He has known of such breaks on poor wire which did not come up to the company's standard specifications. The moral is that with rigid specifications followed by tests, much longer spans with solid copper can be made. We have eight miles of No. 5 line with 150-foot spans with wire which did not stand a very good test which has given no trauble. Stranded copper, however, is superior for 225-foot span work in that:

1. A careless lineman in nicking it reduces its strength less than by nicking a solid wire. A test was made on one cable during which one strand broke at a five-inch sag on 225 feet, but the cable still stood up.
2. Its strength is more uniform throughout its length and therefore a less sag can be safely depended upon.
3. It has a higher strength per square inch because the wires are smaller and are individually stronger.
4. It has a spring effect or untwisting factor of safety.
5. It has a higher elastic limit.
6. It is believed, but not proven, that stranded copper will not burn off so easily as solid wire on account of its



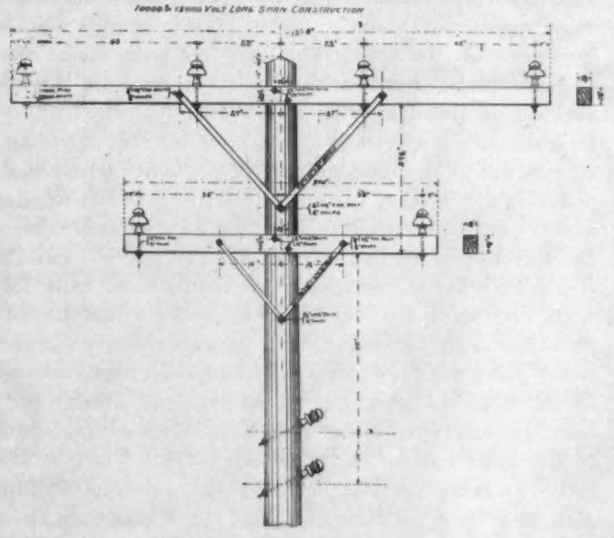
A 10,000-VOLT HORN SWITCH.



TRIPARTITE POLE WITH WOOD CROSS-ARMS

radiating facilities, and because one or two strands will hold the cable intact if the other strands burn off. It costs from 8 to 12 per cent. more than solid wire of the came conductivity.

Following out these considerations, four miles of experimental line were installed in two sections. One in the Lytle Creek district near San Bernardino, two miles long, of three-strand No. 5 copper, and the other at Anaheim, of No. 5 seven-strand copper. In the former a 500-foot span was inserted. Otherwise the constructions are identical and have stood over a year and have passed through the most severe wind storms known in this section for many years. The poles and corner pins now stand perfectly straight, although another new line near by with 140-foot spans and six wires leans badly from the wind. These medium-span lines were of course installed with care and with trusty men who have been with the company for several years.



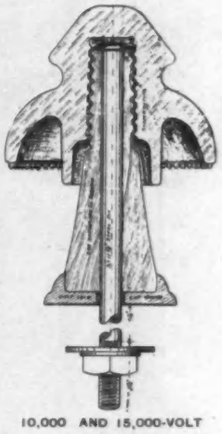
10,000- AND 15,000-VOLT LONG SPAN CONSTRUCTION

The top cross-arm of Figure 1 with three cables only, No. 13 Locke oak pins with a bolt center, two and one-quarter inch washers under each pin and nut, ordinary deep-groove double-porcelain insulators (selected) with a piece of copper wire netting under each to prevent the burning of pins, three strands of No. 17 medium hard drawn copper wires twisted together for a telephone cable which was strung on transposition glass and No. 13 Locke pins, and transposed every third pole, were some of the features of construction.

Mogul paint was used on all threads, nuts, and points of contact of iron and wood and in the ganes, and galvanized iron wrapped around the poles under the guy wires.

The strand was not allowed to touch the ground and was spliced by twisting with an annealed and flattened copper tube. (See *Electrical World*, Volume XLIII, 1904). A double lock tie of No. 8 wire was used with a wood covered tie wrench and no pliers and come-alongs were alowed on the job. All kinds were eliminated with a splice.

They are both 10,000-volt lines and the advisability of using deep-groove double-petticoat insulators will be questioned. Seven years actual service, however, has shown them just as good as any. In fact, there are indications that they are better. They seem to discharge the line without burning the pins. Mechanically speaking, they are superior because the wire is let down closer to the cross-arm. They should, however, be used with caution because the conditions on other systems and localities might not be similar. The following are representative specifications used for stranded copper cables:



10,000 AND 15,000-VOLT INSULATOR

1. This copper cable is to be used for long span work with 225 to 300-foot span. The cable must be bare and composed of seven medium hard drawn copper wires. The cable must have a resistance of .3944 ohms per 1000 feet; that is, equivalent to No. 6 of 100 per cent. Mathiessen's standard conductivity.

2. The cable must have a lay not greater than four inches; that is, one turn of each wire around the cable in four inches of its length.

3. The cables are to be furnished in such lengths that no splicing of individual strands is necessary. When the length of one wire in the strand runs out, the whole cable is to be cut at this point by the manufacturer, which is to be eventually spliced by means of copper sleeves when the line is constructed.

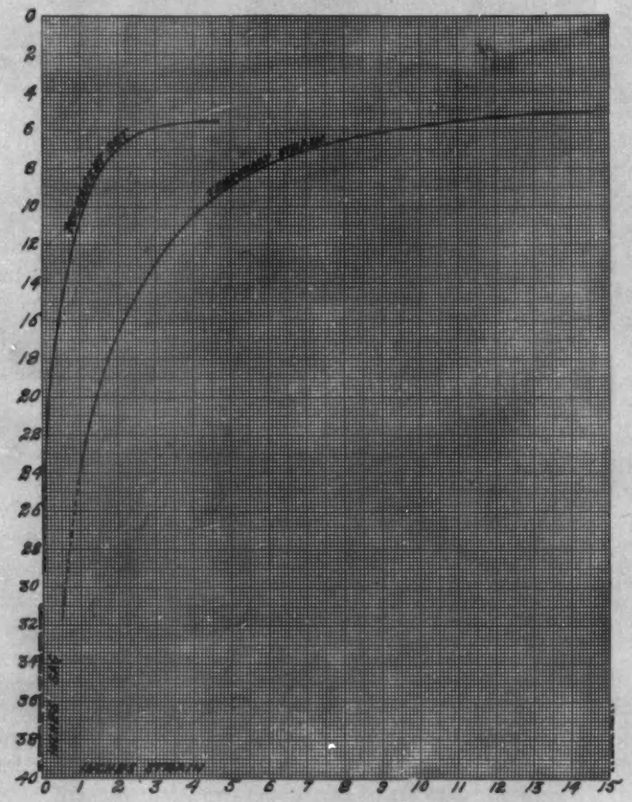
4. The cable must be pulled through a non-corroding grease bath before being reeled to prevent the chafing of the cable against itself in shipment. Paraffine is sugested. The reel must be braced with tongue and grooved.

The strength of the cable must be such that it can be pulled up to a five-inch sag on a 225-foot span. (To be

strung with a fifteen to twenty-four inch sag on the actual line.) In accepting the cable, seven samples will be tested from various portions of the shipment and five must stand a five-inch sag, while two will be allowed to break at this sag. Twenty-five samples of individual strands will be taken from the shipment and given a twisting test; that is twisted six times on and off its own diameter. In such a test the strands must show absolute uniformity of material and drawing. The surface of these individual strands must present a good luster and be free from seams, drawing nicks and slivers.

5. Bids are solicited on this cable, manufacturers to specify weight per foot and price per foot.

The writer lays great stress on the old twisting test, as it is found to be an extremely good gauge of uniformity



of the product. It is not considered advisable to have a wire of 70,000, 50,000, 30,000, 65,000, 40,000 pounds per square inch ultimate strength at various points along its length. It is more advisable to have it uniformly from 45,000 to 50,000. The twisting test determines this, and in a rough way the tensile strength.

Tests on the seven-strand Anaheim cable and the three-strand telephone cable showed an ultimate strength of 59,500 pounds per square inch, corresponding to a five-inch sag on 225 feet. An actual span was used for the test and remarkably uniform results were obtained, the cable breaking at just five inches sag each time. A stress-strain diagram of this cable is given herewith. Note that at five and one-half inches sag the cable had stretched eleven inches in 225 feet and had a permanent set of 4.6 inches. Subsequent cables have broken uniformly at 63,250.

After all, the important factor of this work is, has the engineer "done for a dollar what any fool can do for two," which brings us up to a consideration of comparative costs.

At the time when this matter was first being discussed, five and one-fourth miles of 30,000-volt line was built from Mentone to the new Mill Creek No. 3 power house. The ground was exceedingly rocky, which made the cost of digging holes from $1.50 to $3.30 each, and the cost of stringing and hauling very great, with two three-phase circuits of No. 4 and 125- and 120-foot spans. A saving of 16 per cent. could have been effected by 225-foot medium span construction with cables, and the line would have been safer because the wires would have been forty-five inches apart instead of thirty-six inches. With No. 6 the saving would have been 21 per cent., while with No. 3 wire, which is about the practical limit of this kind of work, a saving of 11 per cent would have been obtained.

There is now being constructed nine and one-half miles or more of medium-span line in Lytle Creek, near San Bernardino, directly in the path of the severe north winds, of the 40-foot, wood pole, 225-foot span construction, with deep groove double porcelain insulators on 10,000 volts. Half of it is to be strung with No. 5 and half with No. 6 cables, and a saving of 24¼ per cent. and 26½ per cent. will be effected. This is a single circuit line prepared for drawing in another one eventually. In single circuit lines where wire is a smaller percentage of cost the greatest percentage of saving obtains.

The company is now building fourteen miles of line from Los Angeles to Inglewood to connect the old United Electric Gas & Power Company's beach town, thirty-eight-mile, 17,300-volt transmission system, which the Edison Company has lately acquired, with the 30,000-volt Edison proper system. This is composed of six No. 4 seven-strand copper power wires, strung on a new special porcelain insulator and the three-strand telephone cable mentioned above. Thirty thousand volts will be impressed on the line. The forty-foot poles are of steel and placed 300 feet apart. The cross-arms are of wood because of the danger of birds burning wires off by grounding, but special iron pins have been designed and all pins are to be grounded together by a fine wire underneath the cross-arm to prevent burning of the wooden parts. The soil is mostly sand, and a cylinder of cement five feet deep is used to set the poles in. Even then the cost is only $48.00 per mile more than a wood pole line with 125-foot spans, because wood poles would have to be taller than forty feet. If, however, forty-five-foot wood poles and 225-foot spans had been used, the cost would mean an advantage of 20 per cent. over an ordinary 225-foot span cedar pole line. This saving is due to the large cost of forty-five-foot poles. The cost of a forty-foot tripartite pole made by the Franklin Rolling Mill of Franklin, Pa., in this steel construction, is about $35.00 f. o. b. Los Angeles, as against $9.00 for a forty-

five-foot cedar pole, so that the above figures are rather surprising. The 30 per cent. + $48.00 per mile excess cost of the 300-foot span steel line over the 225-foot span wood line is what the company pays in first cost to prevent depreciation. The advantage is gained that, should the line ever be changed or moved, the poles would be as good as new for a new place. Ordinarily, in such cases, even though the poles are not rotted badly, they are not worth placing again without sawing off. This principle, which is often lost sight of, is especially applicable to city distributing systems.

It will be observed that this construction is especially advisable on lines with small wires, *i. e.*, telegraph, telephone and power lines of Nos. 3, 4, 5 and 6 wire. The percentage saving on single circuit lines is especially great, and the percentage saving is greater the greater the cost of poles and digging holes, and particularly where the poles must be hauled a great distance and when the company must provide tents and eating facilities along the line in building. On high voltage lines, where the insulators cost considerably, the saving is very patent.

Perhaps the principal mechanical, and therefore ultimate, monetary advantage in medium or long span work is the greatly reduced trouble with insulators and pins, and burning off of poles, and in fact all the troubles which lines are heir to, by making the parts fewer and each better, which, by the way, greatly reduces the necessity for double-pole lines. In other words. make good porcelain eggs and make them larger and stronger than are usually laid, put them in one good strong basket, and watch the basket, and it will not cost so much to watch the basket, either, as it usually does.

It will often be found, especially in this western country, that, by building a line quickly, not only is money saved in construction, but revenue and profit is more quickly obtained or lost power more promptly eliminated. Medium span wood pole lines are built in 60 per cent. of the time usually employed.

This construction would seem advisable also for long distance telephone and telegraph work in certain sections, and where it is presupposed that a first-class line of long life and of no trouble while it lives, is the more economical one in the end.

Only in rare instances does the fifteen to twenty inches sag instead of eight make any difference in the height of poles. Private telephone lines should be at least five feet below the lowest power crossarm, and at least eight feet above the tallest trees, which usually dictates the height of poles. These methods may become important in case a double-pole line is considered advisable where small amounts of power are transmitted at high pressure or small distances.

It may be argued that copper for telephone work on long-distance transmission lines is too expensive, but it will last forever, be freer from induction, and its percentage of total cost per mile is very small. It is dangerous to pull in a new telephone line alongside of an old old one on transmission lines when the old one is worn out. But if iron must be used, why not use three-strand steel wire on long span work and the above figures will not be altered by more than 1 per cent.

The question of the preservation of poles from decay is of some importance in this discussion. Granting that a good, cheap, practical method of preserving poles at from 75 cents to $1 per pole can be found—and we are making rapid progress in this direction—the saving by using this medium-span construction is greater than cited above, and entirely removes the question of the greater weakening of the line by the decaying of poles in the longer span construction.

In conclusion, it may be said that by effecting a saving of from 10 to 30 per cent. in lines ordinarily costing from $700 to $1700 per mile, and having from three to twelve of the smaller sizes of wire, a slight advance has been made in the art, in the field of light construction, where the cost of poles, freight and haulage is great, especially as they are better and safer lines than are ordinarily built with more cost, or stating it another way, they are as cheap as the cheapest allowable lines and twice as safe and free from trouble and danger.

THE REGULATION OF TRANSMISSION LINES.

BY J. A. LIGHTHIPE.

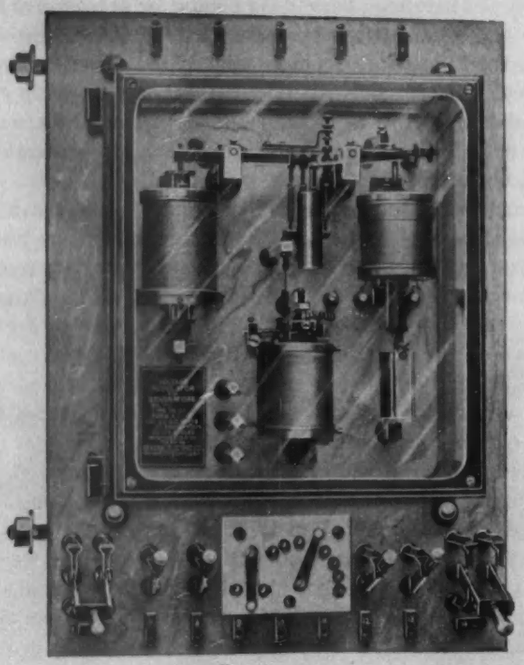
IF you take a tap off of the resistance box that is in circuit with the fields of an exciter that is charging the fields of an alternating generator, and short circuit a portion of this resistance, you raise the voltage of the generator. On opening this shunt the voltage drops again. You will notice that this change of voltage is not instantaneous, but there is quite an appreciable time if the generator is large. Now, if you make and break this contact more or less rapidly you will find that you can keep the voltage at almost any point you desire between the high and low limits. Arrange a device to do this automatically from a voltmeter and you have a Tirrill regulator. The Tirrill regulator at present is made in two types "TA" for alternating current and "TD" for direct current.

These regulators work by rapidly opening and closing a shunt circuit across the field rheostat, and the voltage is maintained by varying the length of time the rheostat is in and out of circuit. Other regulators are inclined to hunt, due to the fact that the regulator arm has to travel over such a long range. This regulator covers the full regulation by a movement of about one-sixteenth of an inch, so that there can be no trouble due to inertia of the moving parts.

The direct current regulator consists of a main control magnet, connected directly across the busbars; or pressure wires may be brought back from the center of distribution. The core of this magnet operates the main

*A paper presented to the Eighth Annual Convention of the Pacific Coast Electric Transmission Association, June 21-22, 1904.

contact points, which points control the relay magnet. The relay magnet has two windings differentially connected—one connected permanently and the other opened and closed by the main contacts. As these windings are differential, they neutralize each other when the contract



TYPE "TA" REGULATOR

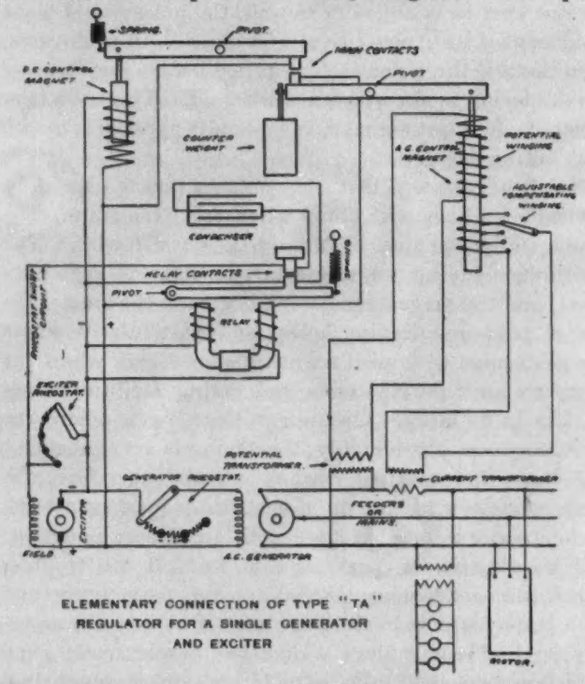
is closed, and the relay magnet is active when the contact is open. This eliminates the arc at the main contacts. The relay controls a pair of contacts which open and close a shunt circuit across the field rheostat.

A condenser is used to take up the arc at this point on opening this shunt circuit. To insure a clean contact of both main and relay contacts, reversing switches are provided in each of the circuits to reverse the polarity of the contact points.

For an alternating current, the voltage is maintained by varying the exciter voltage it will work at any frequency, and the regulation is not affected by speed changes, unless the speed is so low that the voltage could not possibly be maintained.

Shown below is an elementary connection of the Type "TA" regulator for alternating current.

This regulator is standardized for exciters up to 100 kilowatts of both 60 and 125 volts. One regulator will regulate any number of generators of any kilowatt capacity, provided they are all run in parallel and the exciters are also run in parallel. The alternating current control magnet in this regulator has two windings. The first a potential winding, that can be connected across the busbars through a potential transformer, or be connected to the center of distribution through pressure wires. The other winding is a series winding supplied by a current transformer. The use of the series winding is to build up a generator voltage in proportion to the amount of current in the line. The compounding effect can be varied by the small switch at the bottom of the instrument, which cuts in or out various turns of the magnet. This alternating current control magnet, in conjunction with a direct current control magnet connected across the exciter bus, actuates a pair of contacts, known as the floating contacts, which operate the relay magnet, which opens

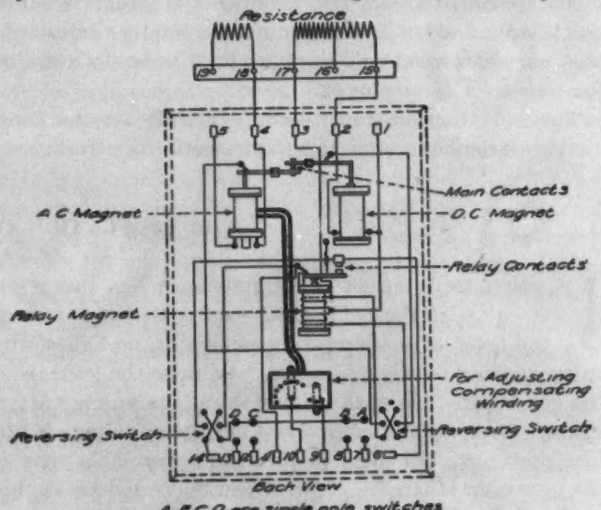


ELEMENTARY CONNECTION OF TYPE "TA" REGULATOR FOR A SINGLE GENERATOR AND EXCITER

and closes the shunt across the exciter field rheostat.

The function of the floating contact is to so actuate the relay magnet that the voltage is maintained under all conditions and combinations of exciter and alternator voltages.

In transmission work this regulator will be a wonderful adjunct and will control the voltage at any and all points



CONNECTION OF THE TYPE "DA" REGULATOR

of the system. If the plant is simple, that is, a power house and one center of distribution, you adjust the regulator for the drop in the line and maintain constant potentail at the center of distribution. As you can compensate for practically any drop, if your power is abundant and

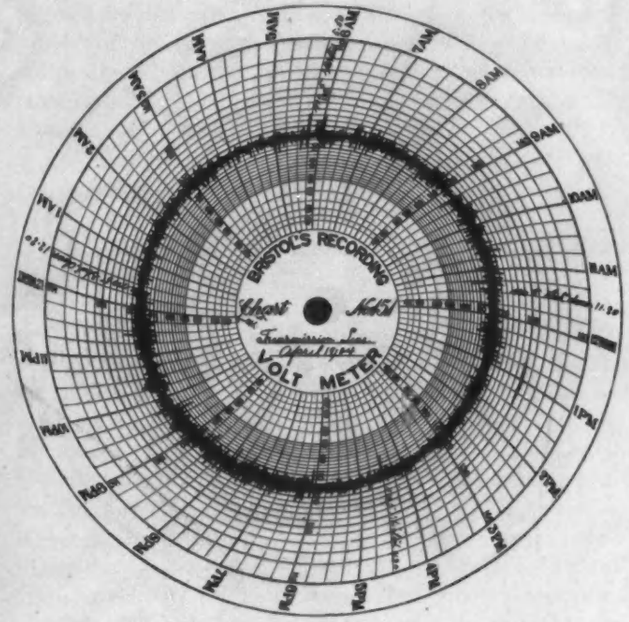


FIGURE 1

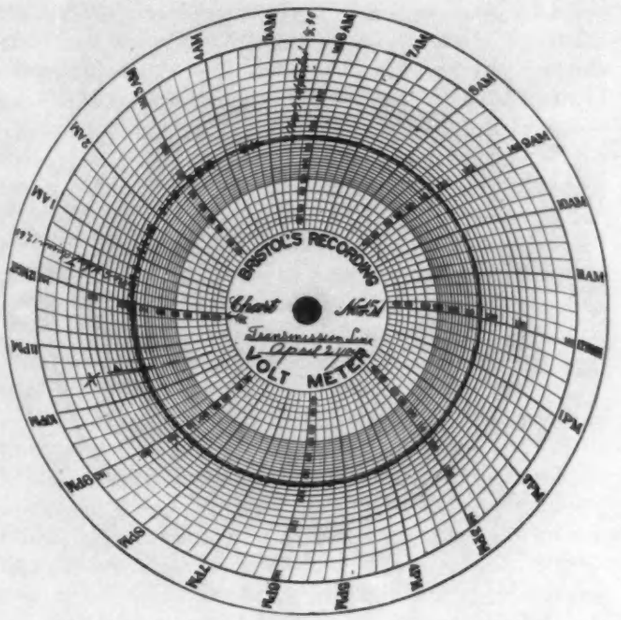


FIGURE 3

the cost of energy cheap, your saving in copper will greatly reduce your first cost. If the transmission system is complex, that is, you are furnishing power and light at several points of distribution, you can control the potential at any point by installing a Tirrill regulator in conjunction with any synchronous motor, and regulate the incoming voltage by changing the power factor of your motor. And this regulator does its work so quickly that the throwing on and off of motors is not preceptible to the eye, and the Bristol recording instrument draws almost a straight line. If the lighting load is large or it is desirable to raise the potential of the substation to compensate for local feeder losses, it would be advisable to use a synchronous motor of capacity large enough to control the power factor as a sort of floating condenser.

Under certain conditions like Spokane, Wash., a large percentage of the alternating current load is distributed in the city. As this power house is in the center of the city, and the Mining load is at the Coeur d'Alene district, 102 miles away, the regulator is installed in the power house at Spokane and adjusted for the local distribution, the variation at the Coeur d'Alene end being due to line drop only. Before this regulator was installed, the lighting service on this circuit in Spokane was very unsatisfactory; in fact, every time the 300 horsepower hoist at the Hecla Mine, at Burke, Idaho, 102 miles away, was used, it dipped all the lamps on the alternating current in Spokane. With the regulator connected there is less than three-fourths of a volt above and below the normal, as shown by the Bristol charts. The results

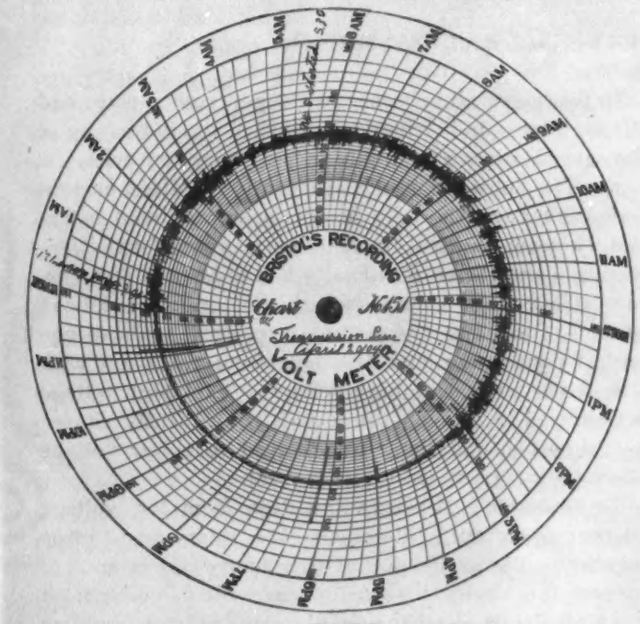


FIGURE 2

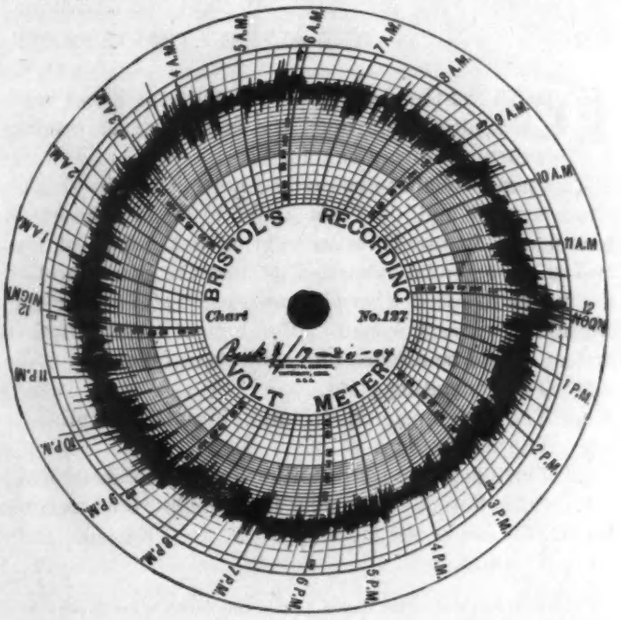


FIGURE 4

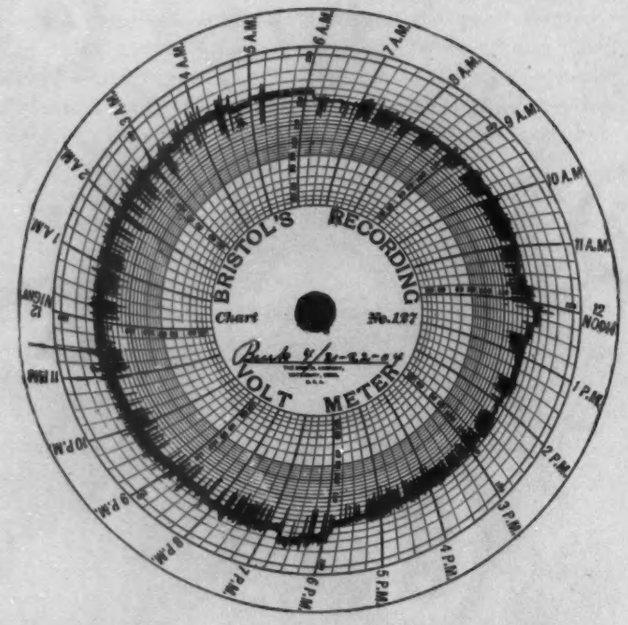


FIGURE 5

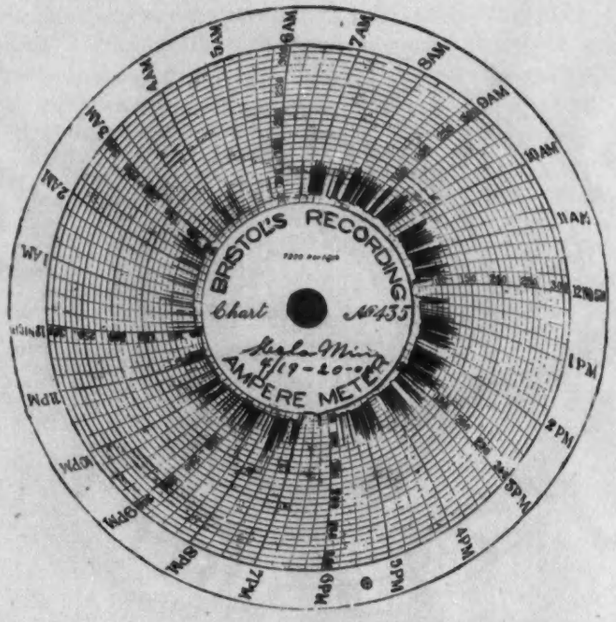


FIGURE 6

have been so satisfactory that it is proposed to install a Tirrill regulator on their three-wire, Edison load, the railway load, and on the synchronous motor at Burke, or, if necessary, to install a synchronous motor as a floating condenser. It will improve the mining service and enable to light satisfactorily the towns of Wallace and Wardner. With close regulation we can successfully use a fifty-watt lamp. This is a much better lamp than the fifty-six or sixty-watt lamp, owing to the higher temperature of the filament and whiter light. This allows more lighting customers with the same kilowatt capacity. An even voltage and steady light for the customer will lift a heavy burden from the shoulder of the station manager.

Below are shown some photographs of the original cards taken at Spokane.

Figure 1 shows the voltage at the power house at Spokane before regulation was installed. Record of April 19, 1904.

Figure 2, April 20, 1904, shows the regulator on for nine hours and off for fifteen hours.

Figure 3, April 21, 1904, record shows the voltage with regulator on.

Figure 4 shows the voltage at Burke, Idaho, 102 miles away, on April 19th, before regulator was installed at Spokane, Wash.

Figure 5 shows the voltage at Burke, Idaho, on April 21st, with regulator installed at Spokane, Wash.

Figure 6, shows the ampere load at Hecla Mine, at Burke, Idaho. This mine has a 300 horsepower induction motor variable speed hoist.

THE ALTERNATING CURRENT SINGLE-PHASE RAILWAY MOTOR.*

BY W. F. LAMME.

DURING the past year and a half there has been muchdiscussion upon the subject of alternating current railway motors.

This paper touches upon only a portion of the single-phase system and does not claim to be an exhaustive treatment, Its aim is rather to bring out points of immediate commercial value and to show the man who has the money to spend where he can save by adopting the alternating current system. For logical treatment this system should be divided into subjects as follows:

1. The generating plant.
2. The high tension distribution from this plant.
3. The substations.
4. The low tension distribution from the substations.
5. Collection of the current from the low tension conductors for use in the motors.
6. The motor.

In this paper all reference to the generating plant and the high tension distribution is omitted and in treating of the substations, we refer only to the rotary converter.

1. The Substations—Until recently the direct current series motor was the only acceptable for railroad work, and whatever means of transmission was used for the generating plant, the current finally had to be in direct current at a voltage suitable for this motor. For railway systems of any size and extent it is usual to have one central power plant and distribute from this plant with alternating current at high voltage. This high voltage is delivered to various substations conveniently chosen for the system and there transformed to a low voltage alternating current and direct current.

To accomplish the transformation from low voltage alternating current to direct current a rotary converter is required. The only object of this rotary converter is to convert the alternating current into direct current; it has a revolving element and a commutator; it requires

*A paper presanted to the Eighth Annual Convention of the Pacific Coast Electric Transmission Association, June 21-22, 1904.

attendance while in operation. Therefore, for the simple process of changing alternating current to direct current to make a condition suitable for the operation of the direct current series motor power companies are required to assume:

1. Heavy cost in the purchase and erection of rotary converters.

2. Expense of attendance.

3. Additional expense for power because of added transforming apparatus.

If this transformation from the alternating current to the direct current is made unnecessary, the above cost and expenses are saved to the railway company. The introduction of the alternating current single-phase railway motor makes unnecessary rotary substations and attendance, hence the saving to the railway company in the adoption of the alternating current single-phase railway motor. The alternating single-phase railway system delivers the alternating current at convenient points along the system direct off the high tension lines through transformers to the trolly conductor, much the same as the lighting and power companies deliver light and power. These transformers need no buildings and no attendants, and the feeding in may be as numerous as necessary to keep the cost of transformers and trolley conductors to a minimum.

2. The low Tension Distribution from the Substations—With the direct current system rotary converter substations are necessary. The first cost and the expense of operation limit their number; it is not usual to place these substations less than eight miles nor more than twenty miles apart, the voltage of distribution of course is about 600. The limiting of the number of substations and the low voltage of distribution makes necessary a large outlay for conductors on the direct current circuits; this outlay in conductors is frequently the largest single item of first cost, and with the rotary converters sometimes amounts to as much as 25 per cent. of the total cost of the electric power system.

If a higher voltage than 600 could be used, a corresponding saving would be realized. Holding in mind the law of electricity that all other conditions remaining the the same, the amount of conductor to transmit the same energy varies as the square of the voltage is applied, we at once see the importance of this question of trolley voltage. For example, assume one point of feeding in; with 600 volts on the trolley conductor we have a certain amount of copper; now if the trolley voltage is changed from 600 to 2400 volts only one-sixteenth as much conductor is required. We realize that this law is not rigid when comparing direct current and alternating current, for with alternating current impedence comes in to modify the law, but this modification we find is not large.

3. Collection of the Current from the Low Tension Conductors for use in the Motors—By the use of the ordinary under running trolley and 600 volts little trouble is experienced in collecting the current for cars or trains of from twenty to thirty tons weight, but as we increase the sizes of the coaches and trains, trouble in collecting the current is soon reached with the under running trolley, and when we come to trains of even medium size it becomes impossible with 600 volts. To date, the methods available for collecting the current to operate trains of any comfortable size appear to have contracted the two—to conductors under the ground in conduits such as cable roads employ; or to a surface third rail, this rail being either continuous or in sections. The former, the underground conductor, is too expensive and is not adopted except in large cities such as New York and Washington; the latter, the third rail, therefore, appears to be the only feasible method remaining adaptable to heavy car and train service where 600-volts direct current is employed.

The third rail as used on elevated structures or out of the way places, where care can be taken and people be kept from getting in contact with it, is well suited to the work; but when applied generally the third rail, among others has one serious objection—it is a menace to human life. There are and always will be curious and reckless people, as well as people who are ignorant of the danger, to get in contact with this third rail and so injure themselves. Of course it is possible in a way to cover or enclose this third rail, but these covers or enclosures are a worry and expens and are liable to be neglected as theire only purpose is to protect a curious public. Also it is possible to make the third rail in sections with automatic contact devices operated from the car to throw in only a small section at a time over which the car is passing, but such automatic contact devices are an added complication and to date have not proved satisfactory; besides they add to first cost and cost of repairs. *The place of the trolley conductor is either underground or overhead and not on the surface.* I believe time will support this opinion.

The overhead construction at 600 volts with one trolley and ordinary speeds and accelerations limits the size of trains to fifty tons. If 6000 volts were employed on the trolley conductor, the same trolley would give the same speeds and accelerations to a train of 500 tons. This is a very heavy train, as heavy as one of our fast overland trains and heavier than the average suburban train.

At first glance we may not appreciate the importance of high voltage on the trolley. By its use the overhead trolley censtruction, the safest and cheapest construction ever devised, is no longer confined to small and light equipments, but the field is very much widened, and except where the law forbids, the overhead trolley covers the whole field of both the ordinary cars and the heaviest train, and makes all other constructions unnecessary.

The Motor—The motor is single-phase and therefore uses but one trolley, the same as the direct current motor; it has a commutator and has characteristics the same as the direct current; like the direct current it is of the series type; or it can be of the transformer type, that is the trolley voltage can be applied direct to the field of the motor and the armature act as a secondary; this the direct current motor cannot be.

For simplicity we here treat only of the series type in which the field and armature are in series upon the

same circuit. This alternating current motor itself is not operated direct off the trolley circuit but off taps from an auto-transformer carried on the car.

The control of the alternating current motor is ideal; we no longer have a complicated drum controller with contact fingers and a magnetic blowout to extinguish the arcs between these fingers and the drum, neither do we have a line of resistances whose only purpose is to waste energy in order to gain speed regulation, but the whole control is accomplished by the use of a cylinder revolving in a magnetic field like the rotor of an induction motor, and almost as simple; there are no contacts, and the power is applied not by steps but by even graduations. Since there is no resistance there is no waste of energy from this source, and therefore with the alternating current system the energy lost in this resistance is saved. Where there is much stopping and starting of cars this item of loss in resistance is large. In heavy city service it amounts to from 20 to 30 per cent. of the total energy delivered to the car or train, therefore, in this case the alternating current motor from this source alone gives quite an item of saving over the direct current motor. The alternating current motor has a power factor; this is because power factor is a property of alternating current. The direct current motor has no such property. The power factor of the alternating current single-phase motor is a fumction of the current passing through the motor and the speed—that is of the real energy put into the motor. All the current passing through the series alternating current motor is useful current and exerts effort to overcome mechanical resistance; in this respect it is different from the polyphase induction motor, and at start has a power factor much superior to the induction motor. The power factor assists in the control. Because of the power factor the alternating current motor of the same size is not quite so efficient as the direct current; however, the difference is small and is made up many times in the omission of the resistance to regulate the speed.

In General—To equip a road 200 miles long with a heavy train service and feed the whole from one central power plant is now a matter of little difficulty; we can generate and distribute from high voltage mains through transformers to a suitable trolley voltage without attendants or the use of excessive expenditures in transforming devices and in trolley conductors; the trolley construction can all be placed overhead, thus increasing its reliability and lessening the danger to human injury or life. We can choose a voltage so that the current to deliver a predetermined energy can be readily collected, and we have a motor system that controls and applies the energy as needed without serious waste and with ease. One dozen power plants properly located would operate a train service from San Francisco to Chicago.

Summing up we find that while the alternating current motor has small objections in that it has a power factor and a slightly less efficiency, still in favor of the motor we have the overweighing facts as follows:

1. The motor is more simple in its control than the direct current.
2. It is the only railway system in which speed regulation is accomplished without the use of wasteful resistance.
3. The control is such that the service can be operated on any position of the controller continuously.
4. Rotary converter substations, with their attendant first cost and expense of operating are made unnecessary.
5. It reduces enormously the cost of secondary or trolley conductors.
6. It makes possible the extension of the overhead trolley construction to heavy train service.
7. It makes possible the equipment of through or trunk lines.
8. Being alternating current there is no electrolysis.

INTERNATIONAL ELECTRICAL CONGRESS.

UP to the present time the acceptance of membership in the International Electrical Congress of September 12–17th, in St. Louis, number 1776; that over 160 specially invited papers are promised, in all, and that 1000 certificates of membership have been issued to those who have become members by sending in their subscription, and about 100 more certificates are about to be issued.

Efforts are being made to secure the manuscript of as many of the 160 papers as possible by the first of July, in order to have them printed in advance and distributed among the Congress members at St. Louis. The programmes scheduled for Sections D and E are here given. The similar programmes of A, B and C have already been published.

All communications concerning the Congress should be addressed to the General Secretary, Dr. A. E. Kennelly, Harvard University, Cambridge, Mass.

SECTION D.

Electric Power Transmission. Chairman, Charles F. Scott; Secretary, Dr. Louis Bell.

Signor E. Bignami, "Electrical Tansmission Plants in Switzerland."

H. M. Hobart, "Conditions Conducive to Economy in Motor Designs."

Monsieur Maurice Leblanc, "Transmission of Alternating Currents Over Lines Possessing Capacity."

Professor G. Mengarini, "Utilization of Hydraulic Powers in Italy."

Professor F. G. Baum, "High Potential Long Distance Transmission and Control."

F. O. Blackwell, "The Tower-System of Line Construciion."

H. W. Buck "The Use of Aluminum as an Electrical Conductor."

V. G. Converse, "High Tension Insulators."

M. H. Gerry, Jr.. "Line Construction and Insulation for High Tensions."

L. M. Hancock, "Bay Counties Transmission System."

R. L. Hayward, "Some Practical Experiences in the Operation of Many Power Houses in Parallel."

J. F. Kelley and A. C. Bunker, "Long Distance Power Transmission.

P. M. Lincoln, "Transmission and Distribution Problems Peculiar to the Single-Phase Railway System."

R. D. Mershon, "The Maximum Distance to which Power can be Economically Transmitted."

P. N. Nunn, "Pioneer Work of the Telluride Power Company."

J. S. Speck, "The High Tension Transformer in Long-Distance Power Transmission."

Dr. F. A. C. Perrine, "American Practice in High Tension." National Electric Light Association Paper.

Dr. C. P. Steinmetz, "Theory of Single-Phase Motors." American Institute Electrical Engineers Papers.

SECTION E.

Electric Light and Distribution. Chairman, J. W. Liebe, Jr. Secretary, Gano S. Dunn.

Professor André Blondel, "Impregnated Arc Light Carbons."

Herr Max Déri, "Single-Phase Motors."

Herr E. de Fodor, "Rates for Electricity Supply."

Signor Ignacio E. Jona, "Insulating Materials in High-Tension Cables."

Professor W. Kübler, "Upon a Means for Compensating the Series Connection of Induction Motors."

Herr Karl Roderbourg, "Storage Batteries."

Signor Ignacio Guido Semenza, "Commercial Limits of Electric Transmission, with Special References to Lighting Service."

Dr. G. Stern, "The Superiority of the Alternating Current for Distribution in Large Cities."

Dr. W. Wedding, "Measurements of the Energy of Light and Heat Radiation from Electric Light Sources."

Arthur Wright, "Recent Improvements in Electrolytic Meters."

Professor S. P. Thompson, Subject to be announced.

B. A. Behrend, "The Testing of Alternating Current Generators."

George Eastman, "Protection and Control of Large High Tension Distribution Systems." National Electric Light Association Paper.

W. C. L. Eglin, "Rotary Converters and Motor Generators in Connection with the Transformation of High Tension Alternating Current to Low Tension Street Current." Association Edison Illuminating Company's Paper.

W. L. R. Emmet, "The Effect of Steam Turbines on Central Station Practice."

Louis A. Ferguson, "Underground Electrical Construction." Association Edison Illuminating Company's Paper.

Gerhard Goettling, "Storage Batteries as an Adjunct to Central Station Equipment." Association Edison Illuminating Company's Paper.

G. Ross Green, "American Meter Practice." National Electric Light Association Paper.

Caryl D. Haskins, "Metering Efficiency on Customers Premises."

Francis Hodgkinson, "Steam Turbines."

John W. Howell, "Incandescent Lamps."

Philip Torchio, "Distributing Systems from the Standpoint of Theory and Practice."

W. F. White, "The Selection of a Distributing System for a Large City."

SECTION B.

General Applications. Chairman, Professor C. P. Steinmetz, Secretary, Professor Samuel Sheldon.

Professor E. Arnold, "Direct Current Commutation."

Dr. O. S. Bragstad, "Compensated Alternators."

Colonel R. E. Crompton, "Standardization of Dynamo Electric Machinery and Apparatus."

M. André Blondel, "Calcul des Alternateurs."

Drs. Elster and Geitel, "Uber die Naturliche Radioactivitat der Atmosphare und des Erdbodens."

Herr C. Feldmann, "The Distribution of Voltage and Current in Closed Conducting Networks."

M. A. Heyland, "Self Regulating and Compounded Synchronous Machines."

W. M. Mordey, To be Announced.

A. Nodon, "Rectifiers."

Sir W. Preece, "Electricity in Ancient Egypt."

Professor C. A. Adams, "Magnetic Leakage in Alternating Current Machinery."

C. Day, "Electric Motors in Shop Service."

J. W. Esterline, "Carrying Capacity of Cables and Conductors."

H. W. Fisher, "Sparking Distances Corresponding to Different Voltages."

Professor H. J. Ryan, "The Design of Insulators."

D. B. Rushmore "The Regulation of Alternators."

Professor E. B. Rosa, "The Influnce of Wave Shape upon Alternating Current Meter Indications."

Dr. Clayton H. Sharp, "The Equipment of a Commercial Testing Laboratory."

Professor H. B. Smith, "Very High Voltage Transformers."

SECTION C.

Electro-Chemistry. Chairman, Professor H. S. Carhart; Secretary, Carl Hering.

Dr. S. Arrhenius, "Methods of Determining the Degree of Dissociation."

Geh. Reg. Dr. W. Borchers, "Electro-metallurgy of Nickel."

Sherard O. Cowper-Coles, "Electrolytic Methods for the Rapid Production of Copper Sheets and Tubes."

Dr. F. Dolezalek, Subject to be announced.

J. Sigfried Edstron, "Electrical Extraction of Nitrogen from the Air."

Dr. H. Goldschmidt, "Alumino-Thermics."

Dr. F. Haber, "Electrolytische Zerstorungen in dor Erde."

Dr. P. C. L. Heroult, "Electro-metallurgy of Iron and Steel."

J. Swinburne, "Chlorine Smelting."

Professor W. D. Bancroft, "The Chemistry of Electro-plating."

A. G. Betts and Dr. Edward Kern, "The Lead Voltameter."

Professor H. S. Carhart and Dr. C. A. Hulett, "The Preparation of Materials for Standard Cells"

Thomas A. Edison, "Alkaline Batteries."

Dr. K. E. Guthe, "The Silver Voltameter."

Carl Hering, "The Units Employed in Electro-Chemistry."

J. T. Morrow, "Notes on Electrolytic Copper Refining."

Professor J. W. Richards, "The Energy Absorbed in Electrolysis."

Professor T. W. Richards "The Relation of the Theory of Compressible Atoms to Electro-Chemistry."

PELTON WATER WHEELS IN NEW ZEALAND.

THE Pelton Water Wheel Company, of San Francisco, has just closed an interesting contract with the Waipori Falls Electric Power Company (Ltd.), of Dunedin, New Zealand. This consists of two Pelton water wheels of 2000 horsepower capacity each for direct connection to 1000-kilowatt, 400 revolutions per minute, General Electric generators. The effective head available is 665 feet, obtainable through 1825 feet of sheet steel rivited pipe, varying in diameter from forty-two inches to thirty-six inches, the latter at the lower end being one and one-half inches in thickness.

Each unit consists of two Pelton wheels, one mounted on each end of the overhang of generator shaft, the rotor being between the two wheels. Wheel centers are of highest grade open hearth steel, the buckets, of the same material, straddling the center and secured to same by means of steel bolts driven in reamed holes. Nozzles are of the combination needle and deflecting type, to insure greatest economy at partial load, and accurate regulation. A heavy cast iron bed-plate carries the generator and the two pedestal bearings, which, together, with the shaft, are furnished by the water wheel manufacturer.

The awarding of this contract at such long range reflects credit on a local industry, in that it was taken in active competition with Swiss and German concerns having representatives on the ground, and it is a further indication that American machinery is held in high regard by engineers in all parts of the world.

According to a statement furnished to the press by the Standard Oil Company upon the probable life of the Kern County oil fields, it is estimated that 3840 acres or six sections of land in the Kern River field will yield 100,000 barrels of oil per acre, or 384,000,000 barrels for the field. The present early production of the field is about 16,000,000 barrels, so that at the present rate of pumping it would take twenty-four years to exhaust the store of oil with which the Standard credits the field.

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EDITORIAL.

THE LEWIS AND CLARK CENTENNIAL.

The election of H. W. Goode, president of the Portland General Electric Company, of Portland, Oregon, and Director General of the Lewis and Clark Centennial Exposition and Oriental Fair, to the presidency of the Pacific Coast Electric Transmission Association for the term ending June 30, 1905, and the official invitation so cordially extended by him to hold the Ninth Annual Convention of the Association in Portland during the Exposition, will doubly rivit the attention of the electrical fraternity of the Pacific Slope upon Portland during the ensusing year. This will be so, not only because of the extraordinary merits of the Exposition itself, but because of the foregone conclusion that the invitation extended by the Exposition will be accepted by the Transmission Association in due season, with the result that Portland will be the convention city in June, 1905.

Speaking in the light of electrical history and achievement, Portland is deserving of every homage that the Transmission Association can bestow upon it, for the influence which it extended upon the industry through the development of power from the Falls of the Willamette, at Oregon City, and its transmission to Portland, fourteen miles away, gave it wide-spread fame. From the local standpoint, the growth of the electrical industry of Portland, dating from the time in the very early '80s, when a single Brush arc lighting dynamo was installed way down in Weidler's saw mill—down the river near the site of the growing Exposition—to the present, is as the acorn and the oak. More than this, the enterprise of Portland gives that city a rank among the foremost of those widely separated communities which furnished the foundation stones upon which has been built the great structure of modern transmission engineering. Well does the writer remember, for instance, the trepidation with which the then-unprecedented pressure of 4000 volts was put into regular commercial service between Oregon City and Portland, and the perversity of the first rotary converter used in America; perverse in that it would seldom start in the right polarity. But of history, more anon, for the present chiefly concerns us.

The Lewis and Clark Centennial Exposition was instituted by an Act of Congress, followed by an invitation issued by John Hay, Secretary of State of the United States to all civilized nations to participate in an international exhibition to be held in Portland from June 1, to Oct. 1, 1905, to commemorate the centennial of the exploration of the great Pacific Northwest territory to the shores of the Pacific in 1805. It is the first international exhibition held west of the Rocky Mountains and is designed to fitly mark an epoch of growth and development, which, great as it has been, is destined to be greater still as "Westward the course of empire takes its way." The "Oregon Country," as that section of America was then called, shortly after became a part of the United States and was subsequently divided into the present States of Oregon, Washington and Idaho, as well as extensive parts in Montana and Wyoming, adding over 300,000 square miles of rich mineral and fertile agricultural lands to the national domain, and its settlement and development have contributed much to national wealth and prosperity.

The expedition which explored this "No Man's Land" was sent out under the leadership of Captains Meriwether Lewis and William Clark, by President Thomas Jefferson, in 1803, and reached the mouth of the Columbia River in 1805. The perilous journey, some three thousand miles overland, was accomplished under most trying circumstances. It has aptly been called "a new Xenophon march to an unknown sea." The expedition was composed of thirty-three men. Their way through the wilderness was beset with obstacles and dangers that gave pause to the hardiest. Captains Lewis and Clark were the first Americans who reached the Pacific Coast overland, and it is the centenary of this momentous event that will be celebrated in Portland in 1905, for the subsequent acquisition of this vast region gave the United States its first footing on the Pacific's shores and opened the way to our great continental development. As this acquisition was one of the most important events in American history, because of the influence exerted towards making the United States a great nation in territorial extent, the American people in general, and those of the Pacific Slope in particular, supported by the Government, have determined that this centennial shall be fittingly celebrated. When its gates are officially opened it will represent an expenditure approximating $5,000,000, and will occupy some 400 picturesque acres in the beautiful suburbs of Portland, overlooking Guild's Lake and the Willamette River.

The city of Portland, numbering 125,000 inhabitants, is an ideal Western American city. It is situated 110 miles from the Pacific Ocean, on the Willamette River, at practically its confluence with the famous Columbia.

It is a common sight to behold the heaviest draught vessels of all nationalities moored in the city's magnificent harbor. Portland holds extensive commercial intercourse with the whole world, her chief export commodities being lumber, flour, grain and the products of innumerable salmon canneries located on the Columbia. Portland does a wholesale business of $175,000,000 annually; its factories produced $49,500,000 in value last year, and it is the first wheat port of the Pacific Coast and the only fresh water harbor.

The Centennial will provide ten commodious exhibit palaces and thereby furnish ample space, free of charge, for all displays, governmental and otherwise, that are offered. Desirable building sites will be allotted, gratis, to those countries wishing to erect special pavilions of their own. The main palaces will be: Foreign Exhibits, Liberal Arts and Industrial Palace, Horticultural Palace, Agricultural Palace, Electricity and Machinery Hall, Mining Palace, Alaskan Building, Government Exhibits Palace, Hawaiian Building and Oceanic Building. Arrangements have been made with the transportation companies so that exhibits at St. Louis in 1904 may be displayed at Portland in 1905, with little or no extra cost of transportation, through the opportunity offered by the free return freight rates established on goods sent to the World's Fair for exhibit purposes. As Portland is the terminal of four great transcontinental railways, and as the Willamette River is one of the boundaries of the centennial site, thus enabling ocean steamers to discharge cargoes directly on the grounds, it is manifest that the facilities for expeditiously and economically conveying, installing and maintaining exhibits at Portland are unparalleled.

The United States Goverement officially participates in the Centennial with complete exhibits representative of every division of governmental function and resource. The following states have prepared, by making appropriations for the purpose, to participate: New York, Massachusetts, Virginia, Minnesota, North Dakota, Wyoming, Washington, Montana, Idaho, Utah, California, Oregon, Missouri, and, provisionally, Colorado, Nevada, Arizona, and other states and territories with which negotiations are pending.

Thus briefly are the purpose and scope of the Lewis and Clark Centennial Exposition set forth, and the single fact that the cash expenditure to be made in building the Portland Exposition exceeds that of the California Mid-Winter Fair by two and one-half times, will give Californians, at least, some idea of the magnitude of the enterprise which our Oregon neighbors will carry out. Electricity will, of course, play no small part in the Exposition and although the gates of the Exposition will not open to the public for nearly a year, it is not too early for the electrical interests of the country, and especially the manufacturing, power, lighting and railway interests of the Pacific Slope, to begin preparations for making most complete exhibits at this, one of the greatest of world's fairs.

THE AFTERMATH OF THE CONVENTION

Now that the labors of the Monterey Convention of the Transmission Association can be viewed reflectively rather than prospectively, it may be authentatively announced that the organization has made a mighty stride toward the forefront of electrical engineering fraternities of the country. Its papers were very valuable ones, its discussions of them where broad and thorough, its scope of organization was made universal as to electrical membership, its sources of income were readjusted so as to place the greatest financial burden upon the full membership class, the feature of an exhibition was successfully inaugurated, and perhaps above all, the charge of localization was dissapated in the determination that henceforth the annual gatherings shall be held in different electrical centers of the Pacific Slope, rather than invariably in or about San Francisco, as has been obligatory heretofore by reason of the Constitution and By-Laws of the Association.

It is indeed difficult, if not impossible, to direct attention to any particular theme which received attention at the hands of the Convention as being of paramont importance, but probably the matter of single-phase development was the point upon which the greatest interest was manifested. Then, too, it is evident that much remains to be accomplished before every feature pertaining to the erection and maintenance of long distance pole lines shall have setttled down to a fixed practice. From all indications there is every reason to believe that this question is one of evolution; that the day of forty poles to the mile is waning, and that the industry is entering into a stage of transmission from short poles and short spans to higher and yet higher with longer and yet longer span construction. Then perhaps twelve towers to the mile, or even less, as the recognized standard. Finally, as the matter of perhaps tertiary interest, was the effort made toward disseminating information as to the best proceedures to follow in bringing about resuscitation from electric shock. The necessity for a concerted plan of education along this direction is formed in the all-to-frequent occurrence of electrical fatility—for instance on May 26th, last, four deaths resulted from this cause on the Pacific Coast alone. Ir deed so potent is the hazard to life, and so frequently is death from electric shock a preventable occurrence, that it would seem to be well worth the expense to the great electric companies to employ a professional resuscitator to periodically visit the various electric stations for the purpose of giving instructions to all employees in the most modern methods of scientific resuscitation. In fact, every humanitarian instinct demands the spread of knowledge of this nature into every quarter.

In accordance with the usual custom, the Convention papers and discussion will appear in full in THE JOURNAL, the first installment of which occupies the bulk of the present issue. The remaining papers, together with the verbatim report of the discussions which were held upon them will be embodied in the August number.

The Monterey Convention.

Those Who Attended and What Was Done During the Eighth Annual Convention of the Pacific Coast Electric Transmission Association.

Promptly at the scheduled time, of course, the Del Monte Express pulled out from the Southern Pacific Depot at Third and Townsend Street, June 21st., with upwards of fifty delegates representing the San Francisco contingent to the Eight Annual Convention of the Pacific Coast Electric Transmission Association. This was on Monday afternoon, and on arriving at Monterey, four hours later, the guests found a cordial reception awaiting them at the hands of the proprietors of The Monterey, the delightful little hotel which formed the Convention headquarters, and which, by the way, was filled, too, with guests to overflowing. Others came on a later train from San Francisco, while still others from the more remote parts of the Pacific Coast had already

SOME VIEWS OF THE ELECTRICAL EXHIBITION AT MONTEREY

reached Monterey when the bulk of the delegates arrived. After dinner the attendants repaired to the exhibition hall, situated a block from the hotel, where the evening was spent very profitably in studying the interesting display of electrical appliances there made.

THE ATTANDANCE

The record of any previous Convention of the Association was broken at the Monterey meeting by the following list, which gives the names of those who were present during the session.

H. G. Aylsworth, manager Kilbourne & Clark Co., 519 Mission Street, San Francisco, Cal.

A. H. Babcock, electrical engineer Southern Pacific Company, 4 Montgomery Street, San Francisco, Cal.

F. G. Baum, chief engineer California Gas and Electric Corporation, 600 Rialto Building, San Francisco, Cal.

W. W. Briggs, sales department Westinghouse Electric and Manufacturing Company, 425 Market Street, San Francisco, Cal.

H. A. Bullard, machinery salesman Kilbourne & Clark Co., 1353 Oak Street, San Francisco, Cal.

W. G. Clark, president Kilbourne & Clark Co., Seattle, Wash.

J. A. Clay, engineer Hecla Mining Company, Burke, Idaho.

Jno. R. Cole, manufacturers agent, 660 Mission Street, San Francisco, Cal.

B. W. Collins, general superintendent Monterey Gas and Electric Company, Monterey, Cal.

B. C. Condit, electrical superintendent American River Electric Company, 334 Weber Avenue, Stockton, Cal.

C. L. Cory, consulting electrical and mechanical engineer, 331 Pine Street, San Francisco, Cal.

F. J. Cram, sales agent Electric Appliance Company, 719 Mission Street, San Francisco, Cal.

R. B. Daggett, manager Electric Storage Battery Company, Rialto Building, San Francisco, Cal.

R. J. Davis, president Standard Electric Construction Company, Rialto Building, San Francisco, Cal.

Robert McF. Doble, mechanical and electrical engineer, 417 Rialto Building, San Francisco, Cal.

Paul M. Downing, superintendent of construction California Gas and Electric Corporation, 600 Rialto Building, San Francisco, Cal.

W. A. Ekberg, representing G. I. Company, 69 New Montgomery Street, San Francisco, Cal.

R. B. Elder, manager Wagner-Bullock Electric Company, Rialto Building, San Francisco, Cal.

J. S. Farnsworth, San Francisco Electric Company, 510 Mission Street, San Francisco, Cal.

Frank Fowden, manager Brooks-Follis Electric Corporation, 527 Mission Street, San Francisco, Cal.

J. M. Gardener, manager Santa Cruz, Garfield Park and Capitola Electric Railway Company, Santa Cruz, Cal.

H. A. Greene, Monterey, Cal.

Will F. Hall, sales agent Roebling's Sons Company, 25 Fremont Street, San Francisco, Cal.

W. W. Hanscom, chief electrical engineer Union Iron Works, Potrero, San Francisco, Cal.

S. J. Hendy, Joshua Hendy Machine Works, 36 Fremont Street, San Francisco, Cal.

George C. Holberton, distribution engineer California Gas and Electric Corporation, Thirteenth and Clay streets, Oakland, Cal.

J. L. Holland, official stenographer, 409 Mills Building, San Francisco, Cal.

C. W. Hutton, superintendent Sacramento Electric, Gas and Railway Company, Second and J streets, Sacramento, Cal.

E. D. V. Johnson, Northern California Power Company, Redding, Cal.

R. F. Johnson, Mayor Monterey, Cal.

E. M. Jones, sales department General Electric Company, Crossley Building, San Francisco, Cal.

George Kanzee, official stereoptician, 131 Post Street, San Francisco, Cal.

Professor F. H. Killick, 2415 Clement Street, Richmond District, San Francisco, Cal.

W. F. Lamme, electrical engineer Westinghouse Electric and Manufacturing Company, 425 Market Street, San Francisco, Cal.

F. V. T. Lee, manager Stanley Electric Manufacturing Company, 69 New Montgomery Street, San Francisco, Cal.

J. A. Lighthipe, chief engineer General Electric Company, Crossley Building, San Francisco, Cal.

M. V. McQuigg, president Monterey County Gas and Electric Company, Monterey, Cal.

Ralph Montague, Oroville, Cal.

A. J. Myers, engineer Wagner-Bullock Electric Company, Rialto Building, San Francisco, Cal.

H. R. O'Bryan, president The O'Bryan Electrical Company, Monterey, Cal.

C. H. Pennoyer, manager United Gas and Electric Company, San Jose, Cal.

Brigadier-General William Quinton, Monterey, Cal.

H. A. Russell, sales department General Electric Company, Crossley Building, San Francisco, Cal.

J. A. Ross, manager Sacramento Electric, Gas and Railway Company, Sacramento, Cal.

Professor George H. Rowe, professor electrical engineering Leland Stanford Jr. University, Palo Alto, Cal.

H. L. Shannon, president Shasta Power Company, Crossley Building, San Francisco, Cal.

Wilton Shuhaw, Suburban Electric Light Company, San Leandro, Cal.

Sidney Sprout, consulting electrical and mechanical engineer, Crocker Building, San Francisco, Cal.

H. B. Squires, manager machinery department California Electrical Works, 547 Mission Street, San Francisco, Cal.

Frank E. Smith, representing Weston Electrical Instrument Company, 183 Jessie Street, San Francisco, Cal.

W. H. Tetley, San Francisco, Cal.

L. F. Turnbull, sales department C. C. Moore & Co., 63 First Street, San Francisco, Cal.

R. W. Van Norden, electrical superintendent Central California Electric Company, 532 Twelfth Street, Sacramento, Cal.

William D. Ward, representing Pelton Water Wheel Company, 127 Main Street, San Francisco, Cal.

E. L. Wayman, manager sales department California Electrical Works, 547 Mission Street, San Francisco, Cal.

C. W. Whitney, representing the *Electrical World and Engineer*, 121 East Thirty-fifth Street, Los Angeles, Cal.

R. H. Willey, Monterey, Cal.

Mrs. J. A. Lighthipe and son, Mrs. C. W. Hutton, Mrs. H. A. Bullard, Mrs. H. G. Aylsworth, Mrs. F. G. Baum, Mrs. W. W. Briggs, Mrs. C. H. Pennoyer, Mrs. F. H. Killick and two children, Mrs. Will F. Hall, Mrs. W. H. Tetley, Mrs. Geo. P. Low, Miss Marian C. Low, Geo. P. Low, Jr.

THE PROGRAM

On the following morning the Convention opened at 10:00 a. m. in the opera house of the town. A full attendance was present and the various sessions of the Convention together with the program which was carried out not only in reference to the addresses and papers delivered but also in reference to the entertainments provided, follows:

9 a. m.—Tuesday, June 21, 1904.

"Address of Welcome," by Hon. R. F. Johnson, Mayor of Monterey, Cal.

"The Convention City," by R. H. Willey.

"The Natural Resources of Monterey," by Brigadier-General William Quinton.

Response.

9:30 a. m.—Roll Call.

"A Proposed Method of Determining Meter Rates for the Sale of Current, with an Example from Data of a Large Steam-Driven Plant," by A. M. Hunt.

"Transmission of Power versus Shipment of Fuel," by A. J. Bowie, Jr.

"High Pressure Water Wheels, with Particular Reference to Girard and Francis Turbines," by E. G. DeWald.

"Ice Interference in Power Ditches at High Altitudes," by R. W. Van Norden.

"A Sixteen-Mile, 80,000-Volt, Experimental Line," by A. C. Balch.

12 m.—Recess.

1:30 p. m.

"Possibilities of Single-Phase Electric Power Transmission," by H. A. Bullard and Sidney Sprout.

"The Alternating Curren Single-Phase Railway Motor," by W. F. Lamme.

"Single-Phase Motors," by R. B. Elder.

"On Securing Absolute Safety in the Use of Telephones in Transmission Service," by H. G. Aylsworth.

"Some Experiences of a Salesman," by H. A. Russell.

4:30 p. m.—Executive Session.

8 p. m.

"Practices and Products of the Westinghouse Shops." by W. W. Briggs.

8:30 p. m.

"The Guanajuato Transmission," by Robert McF. Doble.

10 a. m.—Wednesday, June 22, 1904.

"Medium-Span Line Construction," by C. A. Copeland.

"Report of Committee on Standard Polyphase Distribution," by George C. Holberton, Chairman.

"Some Experiences in the Regulation of a Three-Phase, Four-Wire, Mixed Distribution, by C. W. Hutton."

"The Regulation of Fluctuating Voltage in Transmission Service," by J. A. Lighthipe.

"Report of the Special Committee on 'Resuscitation,'" by Robert McF. Doble, including a physical demonstration

THE BANQUET.

The Monterey, 8:30 p. m., June 22, 1904.

MENU

A Martini
Eastern Oysters on the Half Shell
Chow-Chow Dill Pickles Olives Radishes
Bouillon en Tasse
Sauterne
Fried Fillet of Sole, Tartar Sauce
Pommes Naturel
Young Capon, Oyster Sauce
Mashed Potatoes
Boiled Lamb's Tongue, Sauce Piquante
German Hot Slaw
Roman Punch
Broiled Squab on Toast Macedonia
Sweetbread in Cases aux Truffes
Pineapple Fritters
Zinfandel
Shrimp Salad with Mayonaise Dressing
Lettuce with French Dressing
Sliced Tomatoes Sliced Cucumbers
Roast Turkey, Cranberry Sauce
Wax String Beans Green Peas
Cazanova Brut '93
Vanila and Chocolate Ice Cream
Assorted Cakes, Fruit, Nuts and Raisins
Swiss, Pineapple, Roquefort and American Cheese
Bent Water Crackers
Cafe Noir
Africana

by Professor Frederick H. Killick.

"A Plea for an Authentic History," by Geo. P. Low.

"Wrinkles," by R. W. Van Norden.

Adjournment.

2 p. m.

Outing—A Cruise on the Bay of Monterey.

8 p. m.

The Banquet, at "The Monterey."

Thursday, June 23, 1904.

The Clam Bake.

THE SOCIAL FEATURES.

The hospitality of the good people of Monterey has justly become a by-word among the electrical fraternity of the Pacific Coast, for it does not seem possible for any community to extend a more genuinely cordial welcome than that held forth by the citizens and ladies of that most interesting old town. Viewed reflectively, the welcome extended was simple, genuine, wholesouled, and, in being utterly devoid of ostentation, was typical of utmost cordiality. On Tuesday morning while the Convention was in session the visiting ladies were entertained by the ladies of Monterey in a jolly tally-ho ride over the famous seventeen-mile drive. That afternoon a reception was given to the visitors in the club rooms of the Ladies Club of Monterey, to which the ladies of the Convention responded by an informal luncheon given at the hotel on the following afternoon.

On Tuesday evening the public were invited to attend the evening session of the Convention, which consisted in lectures on electrical subjects that were illustrated with probably 150 lantern slides. The first of these presented a series of stereoptican views of the great East Pittsburg shops of the Westinghouse Electric and Manufacturing Company, together with views of some of their enormous products. The slides were presented by W. W. Briggs, who was accorded a cordial welcome. The particular interest of the evening session, was, however, centered in the remarkably graphic lecture given by Robert McF. Doble upon the Guanajuato Transmission Plant, which was replete not only with descriptive matter but also with landscape and constructional views and engineering details. The lecture, together with many of the views which illustrated it, will be presented in THE JOURNAL for August as well as in the proceedings of the Association.

At the close of the evening session at 10:30 p. m., a surprise as delightful as it was unique awaited the Convention in the form of a reception given by Mayor R. F. Johnson and his esteemable wife in their home—their "Bungalow"—which is a modernized appellation for a collection of old Spanish adobe buildings that still exist in a state of perfect preservation and maintenance despite their age of a century or more. There the society of Monterey awaited the visiting delegates and their ladies with music, with refreshment, with beautiful electrical illuminations, with historic anecdotes and traditions, and, above all, with a warmth of hospitality which can never be excelled. Indeed the recollection of this delightful evening at the Bungalow will never be effaced from the memories of those who in attending the Monterey Convention were so fortunate as to have participated in it.

The banquet was held at The Monterey on Wednesday evening with some fifty guests in attendance. It was throughout a most enjoyable repast and one which under the toastmastership of the Secretary of the Association was replete with wit and merriment until the early hours of the morning.

THE CLAM BAKE.

Probably it is better naught should be detailed concerning the clam bake, for the efforts that were made to heat a rock containing several hundred thousand cubic yards of material with a little camp fire proved futile, and although a liberal assortment of tempting viands were adroitly laid in savory seaweed, the heat was not there. After an hour of "baking" the clams were uncovered. Evidently the slight warmth felt good to them, for their lively necks supported merry faces that laughed joyously in rhythm to the pounding of the surf. But cold roast turkey and sundry varieties of sandwiches and tamales and beer and cigars and other good things abounded, so none were hungry and all were happy in the enjoyment of an outing.

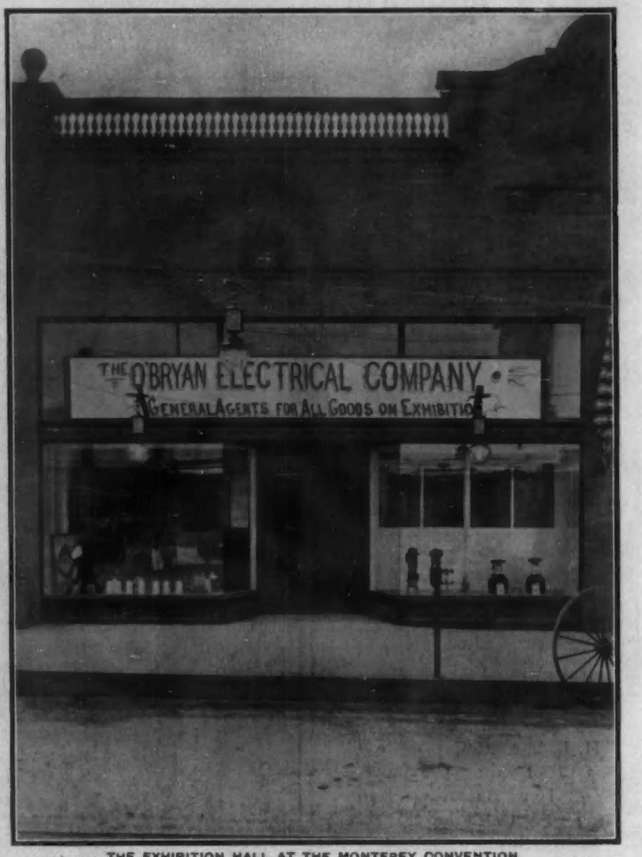
As to the clams, it is probable from the colony planted there on that memorable day in June, 1904, that the vicinity of Pebble Beach will soon become populous with these luscious bivalves; as to the ride to and from the "clam wake," it was truly delightful; as to the livery bills incurred (for livery was the monumental part of the expense of the clam bake) their co-efficient is found in the formula:

$$\frac{L\ B}{G\ B} = 1$$

where $L\ B$ = Livery Bills
and $G\ B$ = Gold Brick. Q. E. D.

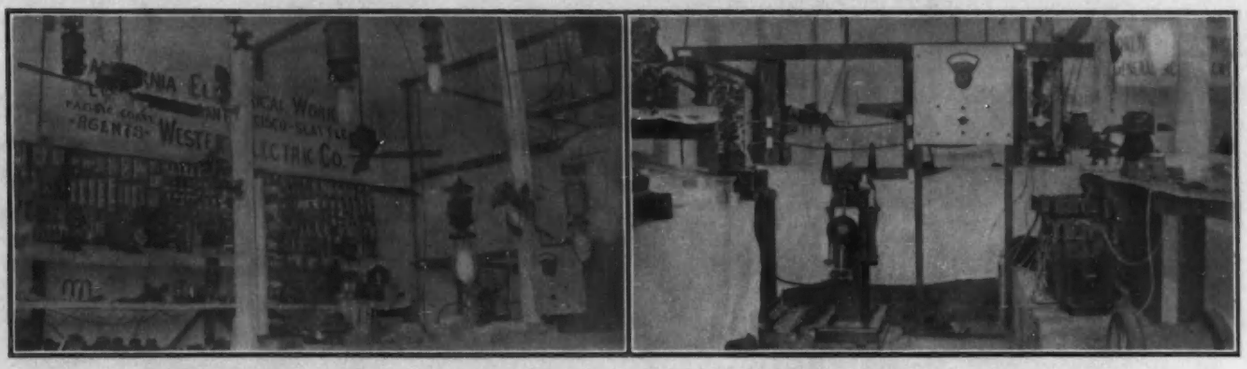
THE EXHIBITION

An innovation as interesting as it is important, and which from the success attained gives assurance that it will become a permanent feature in all future conventions of the Transmission Associa-



THE EXHIBITION HALL AT THE MONTEREY CONVENTION

tion, consisted in an exhibition of electrical appliances made by different firms of the Associate Membership class of the Association. This exhibition was located in the new Preble Building on Alvarado Street, the principal thoroughfare of the town, and the space allotted for the purpose consisted of a storeroom twenty-five by fifty-five feet in size with two ample show windows. A five-foot aisle extended from the main entrance to the rear of the hall and on either side of this were arranged the various exhibits. In point of fact the space which was available did not begin to satisfy the demand for it, and the lesson was well learned that in subsequent conventions larger quarters must be provided for the accommodation of the exhibitors. On entering, to the left appeared the exhibit of the California Electrical Works, occupying a space of ten by twenty-five feet exclusive of the show window, which was filled with a well selected variety of electrical supplies of every description. The most prominent piece of machinery in operation



TWO VIEWS OF THE EXHIBIT OF THE CALIFORNIA ELECTRICAL WORKS

in this exhibit consisted of a twenty-five light series alternating current arc light system complete with regulator the features of which, together with those of the other exhibits to be enumerated, will be given later on. The remaining portion of the space on the left or easterly side of the hall was occupied by the exhibit of the General Electric Company, which is also about to be described.

To the right of the aisle the first exhibit made was that of Messrs. Chas. C. Moore & Co., engineers, who showed in particular an electrically driven gate valve. Next followed the exhibit of the Wagner-Bullock Company of California, occupying a space of ten by twenty feet, and a small portion of which contained the exhibit of the Weston Instrument Company, represented by Frank E. Smith. The Wagner-Bullock display was also an operating exhibit in that a single-phase motor was used to drive a Bullock generator which furnished direct current to all the direct current apparatus used about the exhibition. The principal remaining exhibitors to whom was allotted space consisted of the Kilbourne & Clark Company, The Electric Storage Battery Company, the Stanley Electric Manufacturing Company, The General Incandescent Arc Light Company, The Brooks-Follis Electric Corporation, the *Electrical World and Engineer*, of New York, and the Elblight Company of California, whose cables gave an ease and grace to decorative illumination that could not be reached otherwise. The features of these respective exhibits will be described later, as stated, but it is interesting to note at this time that the Association was able to allot space in the exhibition to its Associate Members without charge owing to the courtesies extended by D. A. Preble, owner of the building, who donated the use of the hall, and to the Monterey Gas and Electric Company, which made no charge for electric current.

The California Electrical Works presented a large and varied exhibit of supplies and power apparatus. In their booth one noted samples of Electrose overhead line material, of Thomas high tension insulators designed for 60,000 volts, as well as of Western Electric single and double pole circuit breakers, fire alarm boxes, and a full line of Emerson single-phase full load automatic start induction motors.

The hall was kept cool by a bank of Western Electric 500-volt direct current and Emerson alternating current desk fans aided by several ceiling and exhaust fans of both makes, and it was brilliantly lighted by a bank of Western Electric multiple alternating and street railway 500-volt series lamps, suspended from the ceiling, several being shown nearer at hand with the cases removed to allow inspection of the working parts.

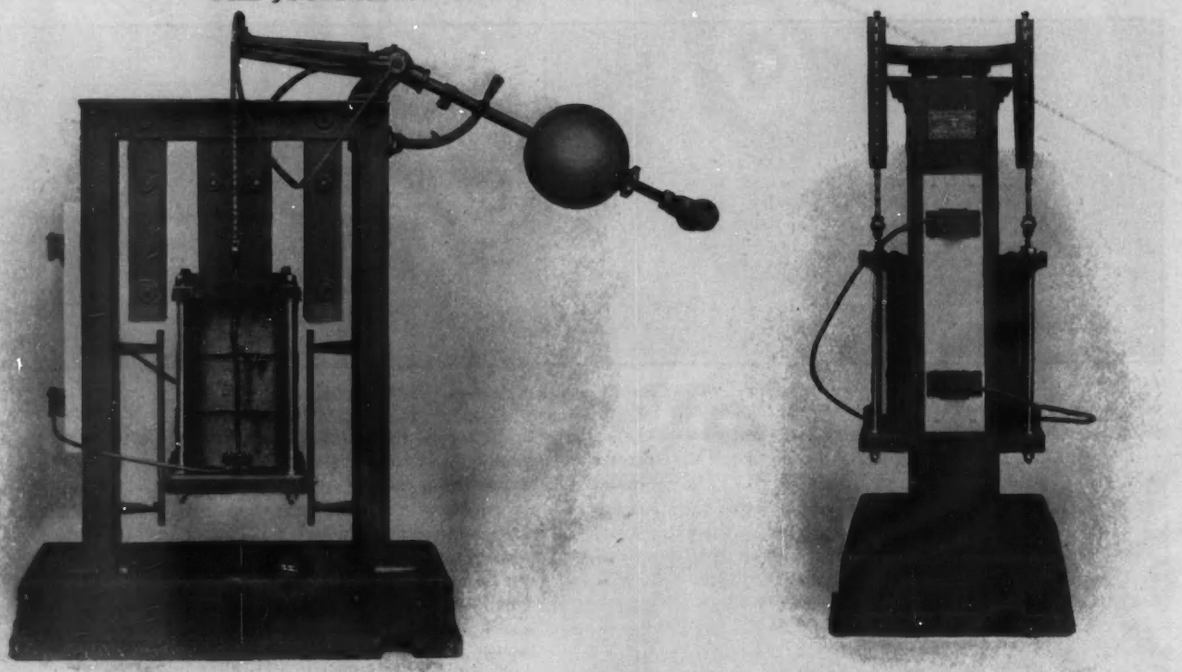
The most interesting part of the display was the operation of a Western Electric twenty-five light series alternating arc light equipment, the lights being swung on span wires from poles on both sides of the street as shown in the accompanying engraving, while inside was the step-up transformer and automatic regulator and switchboard, on which was mounted an ammeter, porcelain barrel type fuses, and a high tension tubular switch. The exhibit made it clear that the Western Electric system of series enclosed arc lighting can be operated direct from the mains or from transformers. In this case a constant potential step-up transformer was used with various secondary taps to suit the actual number of lamps in use. By this means a higher average efficiency and a practically constant power factor from one-half to full load is obtained, this being of special importance where the arc system is installed in combination with the existing incandescent lighting systems, as it avoids the great liability of overtaxing the generator to supply the extra energy required when operating on a system in which the power factor is low. Regulation is obtained by means of an automatic reactance coil or regulator, which in mechanical design embraces features that reduce the inertia and friction to a minimum, and which maintains a constant current within one-tenth of an ampere, its range covering all conditions from full load to short circuit, and such is the extreme delicacy of adjustment of this regulator that when controlling a circuit of fifty lamps a manual movement of the carbons of one lamp up or down a short distance will cause a very perceptible motion of the regulator.

THE "W. E." SERIES A. C. ARC LAMP

The arc lamps operate on the differential principle of the opposing action of shunt and series coils which maintains practically a constant current through the arc. The regulation of arc voltage is obtained by means of a weight, no spring being used for adjusting any part of the mechanism.

An important feature of this lamp is the ability to burn cored carbons in both upper and lower holders. This gives an arc at least 20 per cent longer for the same voltage than can be obtained with one cored and one solid carbon, and there is in consequence a better diffusion, less loss by obstruction of carbons, higher efficiency in the arc, and a clearer, softer quality of light. The lamps in this case operated at seven and one-tenth amperes, but they can be adjusted for any current from four to seven and one-half amperes.

In addition bulletins were distributed illustrating and describing the Western Electric, type L direct connected and belt driven generators, which are manufactured in capacities up to 1500 kilowatts, as also printed matter describing their standard types of open, semi-encased and encased types of direct current motors. The interests of the California Electrical Works



FRONT AND SIDE VIEWS OF THE WESTERN ELECTRIC SERIES A. C. ARC REGULATOR

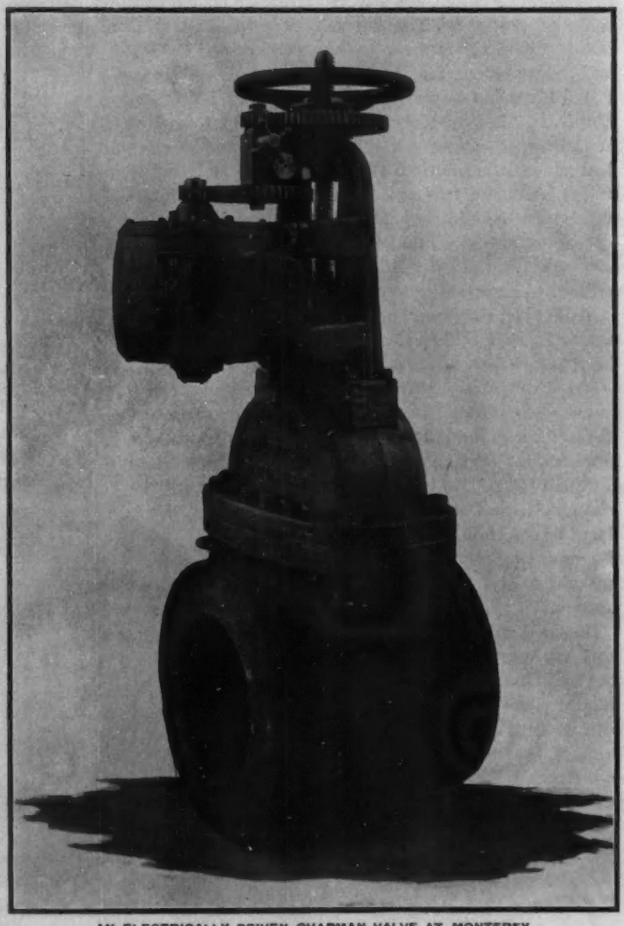
were represented by E. L. Wayman, manager of supplies and H. B. Squires, manager of machinery and appliances, both of whom made many new friends.

The display of the General Electric Company, consisted of a very complete line of its well known products, specially among which were its edgewise-wound direct current arc lamps and magnatite arc lamp, concentric diffusers for arc lamps, meridian lamps, Thomson type I induction motors, fan motors, type H transformers, double-pole circuit breakers electric cooking and heating apparatus, and sample boards showing all types of enclosed fuse cut-outs ranging in capacity from three amperes at 125 volts to 500 amperes at 500 volts. Owing to the fact that the outer globe of the magnatite arc lamp had been broken in shipment, it was impossible to show the true value and the great advantage of the lamp, but nevertheless it attracted a great deal of attention and was the subject of no little favorable comment on the part of the visitors.

The exhibit of Messrs. Chas. C. Moore & Co., contained several models of the well known steam appliances which they handle, but despite them, interest in this exhibit centered in the display of electrically operated Chapman gate valves which were there shown in operation.

These valves call for more than passing mention, for in the erection of modern power plants, the importance of the gate valve is either frequently lost track of or regarded as a secondary consideration, whereas it is really one of the most important appurtenances of hydraulic equipment. Its makers express the belief that hand, hydraulic, pneumatic and steam-driven valves are inadequate for all purposes and pressures, and that the merits of electric motors as a means of supplying power for a multitude of purposes makes them particularly adapted to the operation of gate valves, in view of which the Chapman Valve Manufacturing Company has adopted the electric motor as its standard method of operating gate valves and sluice gates for either nearby or remote control. Especially is it pointed out that electrical control solves the problem of the rapid handling of gate valves under every ordinary condition as well as in cases of emergency.

In the designing of such apparatus, the conditions governing the application of the electric motor to the valve were found to differ entirely from the application to all other machinery, inasmuch as the travel is, of course, limited to the size of the valve opening. The problem presented, though rather difficult, was overcome by the use of a motor especially adapted for the purpose, together with a lost motion device which enables the motor to attain practically a run-away speed, as it is series wound.

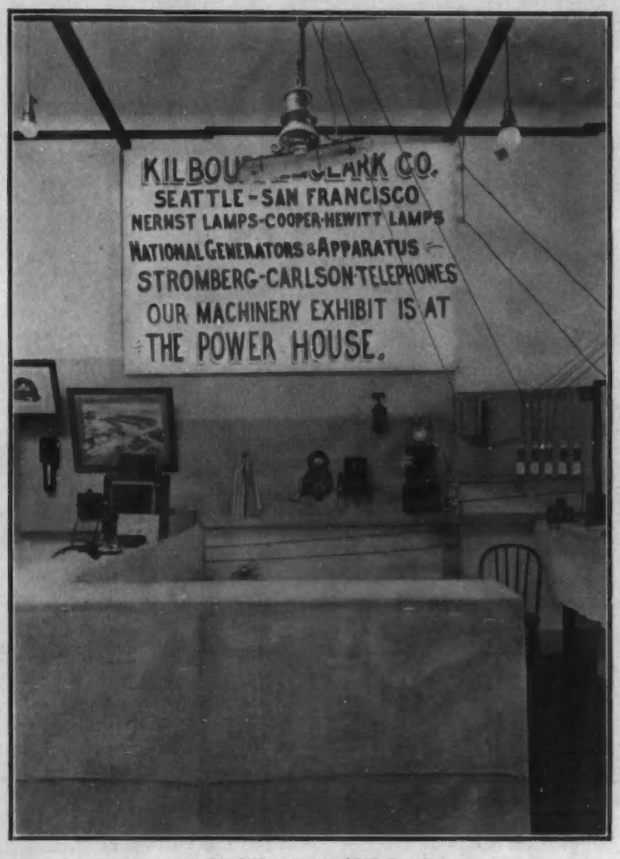


AN ELECTRICALLY DRIVEN CHAPMAN VALVE AT MONTEREY

Owing to its peculiar winding, the motor exerts the greatest possible torque, at the same time striking a hammer blow which is bound to unseat the valve, no matter how tightly closed. Furthermore automatic indicating and controling devices, no matter how remote, make electrically operated valves indispensable.

Valves of this class are especially suited for water, steam and oil lines, and for low pressure work, such as exhaust and condenser piping, pump-suctions and discharge sewage and irrigation systems. They are also extensively used on the receiver piping of compound and triple expansion engines, and are rapidly coming into use as throttle valves on steam turbine units.

These valves are intended to withstand hard usage and their design may be readily modified to meet special requirements. The compactness and simplicity in construction of the patented arrangements enable the use of a very small motor for the operation of these valves. However, the motors are amply large to



KILBOURNE & CLARK CO'S EXHIBIT

open the valves under all conditions, and in closing there is no danger of forcing them to their seats so tightly but that they can be easily opened without the intervention of hand power. They are made in all sizes and lists from six inches to seventy-two inches, and for both direct and alternating current in any voltage, phase or frequency.

The exhibit of the Weston Electrical Instrument Company, made by Frank E. Smith & Co., Pacific Coast representatives consisted of the Type "K" or small round pattern isolated plant instruments, the Type "F" or regular round pattern feeder instruments, the standard portable type of ammeters and voltmeters and ohmmeters, and the new "dead beat" alternating and direct current portable voltmeters and wattmeters. This "dead beat" feature in Weston alternating current instruments is a new departure which makes it possible to make readings as with the direct current type. The old familiar brake that was manipulated by the key is now done away with, the only purpose of the key being to open or close the circuit.

The principal feature of the exhibit of the Wagner-Bullock Electric Company, of California, consisted in the exploitation of the Wagner single phase motor. Two motors of this type were shown, one being of a capacity of one horsepower, so erected to be easy of access and allow of ready examination, and the other being a fifteen horsepower motor from which was belt-driven a fifteen-kilowatt, 120-volt direct current Bullock generator, the output of which was consumed by the various direct current appliances used in the exhibition hall, such as the Cooper-Hewitt lamp, fan motors, the vertical drill motor of the Northern Electrical Manufacturing Company, and numerous direct current arc and incandescent lamps, included in the latter being the beautiful display of decorative lighting made in colored lamps through the use of Elblight cables. These motors were, as stated, each of the single-phase Wagner type and were operated at 208 volts in sixty-cycle current, the latter being supplied for the motors through a three-kilowatt type "M. H." Wagner transformer and a fifteen-kilowatt type "M." Wagner transformer respectively. The accessory apparatus used in conjunction to this motor-generator set consisted of a fifteen horsepower non-inductive starter, a Wagner power factor indicator and four, type "F" direct current Wagner instruments consisting of two ammeters and two volt meters. In addition there was exhibited a Wagner three-phase ammeter and three series transformers of different alternating current applications. In its particular direction, the exhibit was a most thorough and convincing one, and in particular was the commercial utility of the single phase motor most efficaciously exploited.

The Kilbourne & Clark Co. exhibited Stromberg-Carlson telephone apparatus, Nernst Lamps, and a Cooper-Hewitt mercury vapor lamp which was something entirely new to a great many of the visitors and members of the Association. It also had on exhibition at the power house one 200-kilowatt National alternator and one 150-kilowatt National synchronous motor-generator set, delivering 500 volts direct current for the operation of the electric railway system of the Monterey Gas and Electric Company.

A 160-KILOWATT NATIONAL MOTOR-GENERATOR SET IN THE MONTEREY POWER HOUSE

The joint exhibit of the Stanley Electric Manufacturing Company, Northern Electrical Manufacturing Company, General Incandescent Arc Light Company and Fort Wayne Electrical Works, though limited in the number of appliances shown, was a very interesting one and attracted fully as much attention as any other display. The only strictly Stanley display consisted in a series of photographs showing the products and Pittsfield shops of the company. In the display were shown in operation a two-horsepower, 220-volt, direct current vertical type motor with patent new type oiling device for tool driving as manufactured by the Northern Electrical Manufacturing Company, of Madison, Wis.; two eight-inch, sixty-cycle, 104-volt, revolving type Wood fan motors manufactured by the Fort Wayne Electric Works, Fort Wayne, Indiana; one 1000-ampere, 750-volt, single-pole, railway type circuit breaker and one twenty-five-ampere Wright discount meter manufactured by the General Incandescent Arc Light Company, of New York.

The Electric Storage Battery Company also made an impressive photographic exhibit which occupied a prominent wall space. In it were shown views illustrating some of its prominent battery installations on the Pacific Coast, among which were noted those of The Seattle Electric Company, in Seattle; the Puget Sound Railway Company, in Georgetown and Kent; the San Francisco Gas and Electric Company, in San Francisco; The Edison Electric Company, in Los Angeles; and the California Gas and Electric Corporation, in Nevada City, Oakland, Temescal, San Jose and Stockton.

PIRATES.

This is the story of the pirates: M. V. McQuigg, a leading citizen of the town, and president of the Monterey Gas and Electric Company, brought his fine two-masted sloop "Sweetheart" up from San Pedro that it might be in readiness to take the attendants to the Convention out on a cruise on the Bay of Monterey on Wednesday afternoon. It was, of course, well provisioned for the occassion, and the time of departure was announced at 2 o'clock. But the Convention was not able to adjourn on schedule time, and it was nearly 3 o'clock when perhaps fifty of the prospective sailors marched in a body to the pier, under the leadership of Mr. McQuigg. On arriving there he was dumbfounded to see his "Sweetheart" ploughing the billows many miles out at sea, and, in the language of ye olden time, he was much wroth thereat. But he rose to the occasion, chartered a gasoline launch and set out in hot pursuit of the runaway craft. The chase proved futile, however, and the party returned empty handed. Then it was found that some half-dozen or so of the attendants to the Convention had boarded the craft at the announced time, and, believing that there were no others to follow, had ordered the skipper to up anchor and away. So off they sailed, out beyond the three-mile limit, on the high seas, taking possession of the craft without the by-your-leave of the owner—all of which was piracy, pure and simple.

But in the mean time, every function of mock and civil government had been organized by the Convention delegates, and upon the return of the sloop she was boarded by peace officers, the "pirates" were handcuffed together, placarded, and marched up through the main streets of the town midst gibes and jeers and shouts of derisive laughter, to the exhibition hall, where the trial took place. For the pirates it was the trial of their lives, for with Pennoyer as a judge, with Briggs as prosecuting attorney, with Cory as attorney for the defense, with Hutton and Bullard as bailiffs, with McQuigg as principal witness for the prosecution, and with Aylsworth as prison photograper (who ordered the heads of the prisoners to be shaved with a broken bottle) there—there was the "limit."

The trial was before a jury consisting of the ladies of the Convention, and the evidence is summarized in the address of the assistant prosecuting attorney, W. G. Clark, which was delivered to the jury during the clam bake on the following afternoon. In it Mr. Clark said:

Ladies of the Jury—these criminals at the bar of Justice are in the habit of being present at a bar where the presiding officer is clad principally in a white vest, a diamond stud, and the front half of a linen overskirt, and who instead of dispensing justice, dispenses liquid provocation in the form of a potential generator, which is named after the most conspicuous plumage of the male member of the henberry family. But on this occasion they are

THE PIRATES OF PENNY ANTES. ONE OF THE SIDESHOWS OF THE MONTEREY CONVENTION

indicted on a charge more serious than the possession of thirst, and one which must be handled in a manner more severe than is possible for the most strenuous wife without assistance from a friend of the family.

Ladies of the Jury, these criminals are charged with rye high balls, also abduction and high piracy on the high seas. These criminals did with malice aforethought and evil intent, capture, abduct, steal, and unlawfully hold, and convert to piratical purposes one Sweetheart, which was the fiancee of one McQuigg, which act has caused the said McQuigg much anguish, and disturbed his equinimity and peace of mind.

The testimony before the Grand Jurors and the testimony before this court shows that these parties (viz., to wit.,) Ross, Wayman, Fowden, and Gardener, aided and abetted by others known under the aliases of "Slats" and "Scissors," and further aided and abetted by John Doe and Richard Roe, did, seize, take possession of, and abduct the said Sweetheart, and did forcibly convert the said Sweetheart into a piratical craft, and so sail her upon the high seas, and also did committ acts in violation of Section 9 of the laws of the Women's Christian Temperance Union in having on board contraband known under the trade of Rattlesnake Venom, all of which acts herein enumerated are unlawful and at variance with Section 45, Article 7, of the rules of the Sunday School Union.

Ladies of the Jury, that the said Sweetheart was converted into a pirate, and that the said criminals are land lubbers and not real sailors, was amply proven by the condition of the said Sweetheart when captured and boarded by the officers of this court who found that the said and heretofore mentioned land lubbers had lashed the dog watch to the lee scuppers, had threaded the main halyards through the teeth of the wind, had leased the port tackle to a foot ball team, and were towing the binacle lamp far astern. The main guys had been suppressed, and the spinnaker boom tied to the anchor causing the pressure in the foc's'le to raise to a point which endangered the safety of the Sweetheart and which threatened to blow up and destroy the fishing fleet in the vicinity. All of these charges gave Sweetheart a rakish appearance which was intended to deceive her relatives and friends.

When captured the piratical crew were lined up along the port scuppers casting masculated bread and other foods upon the waters, and I have before me petitions from Tom Codd, Bony Shadd, A. Shark, and Sandy Clam, all declaring that the herein named prisoners have committed a nuisance by fouling and imparing the purity of the water which is so essential to their good and welfare, and they ask that the prisoners be suppressed. The petition is presented by Sandy Clam, who is today a warm friend of ours, and as such this petition must receive consideration.

Ladies of the Jury, it is for you to determine whether the high crime of abducting a gentleman's Sweetheart shall go unpunished. It is necessary that this case be given careful consideration, and if a punishment sufficiently severe can be fouud, the prisoners at the bar should get it all, as they have endeavored to poison Mr. McQuigg's mind against his Sweetheart by claiming that she joined the expedition of her own will and accord. This, Ladies, is not so, as no Sweetheart with a record as clean as hers has been would join such a band of pirates without a chaperon.

In closing I have to advise you that it was only with difficulty that a reconciliation was brought about between Mr. McQuigg and his Sweetheart, and finally, Ladies of the Jury, I request that for the sake of Sweethearts you be not influenced by sympathy for these pirates. The court will instruct as to the enormity of their crimes and they must be found guilty.

And found guilty they were, the sentence of the court—which was extreme—being that each and every one of them should be securely muzzled and confined for six months in a brewery.

A souvenir of the incident is being issued by the Kilbourne & Clark Co. to those of the fraternity who apply for it. This consists of a photograph of "The Pirates" daintily mounted on card upon which is printed, under the photograph, the following inscription:—

These thirsty "Pirates" were captured at Monterey during the Eighth Annual Convention of the Pacific Coast Electrical Transmission Association. They were sentenced to six months in a brewery with a muzzle on, but were subsequently released on $26.00 bail by Judge (?) Pennoyer. Being solicitous for the welfare of the electrical fraternity we are sending you this photograph for your future protection as well as a souvenir of the "good time" we had at Monterey. Kilbourne & Clark Company, National electrical machinery, Nernst lamps, Seattle and San Francisco.

THE EXECUTIVE SESSION.

During the Executive Session of the Association, which was held late in the afternoon of Tuesday, and at which there were present representatives of The Edison Electric Company, of Los Angeles, the United Gas and Electric Company, San Jose, the Northern California Power Company, Redding, the Central California Electric Company and the Sacramento Electric, Gas and Railway Company, Sacramento, and the Oakland Gas, Light and Heat Company, the principal business transacted consisted in the reorganization of the Association, which was effected through changes made in its Constitution and By-Laws. As amended, these now make any individual, firm, or corporation which is engaged in any branch of the electrical business or in any branch of engineering or manufacturing enterprise catering thereto, eligible to membership in the proper one of the three classes of membership of which the Association consists, namely, Regular Members, Associate Members and Associate Engineers. In view of this, while regular membership has heretofore been restricted to companies engaged in the electrical transmission of power through circuits operated at a minimum potential of 5000 volts and at a minimum distance of five miles from the power house, it is now possible for ever individual or concern owning a plant for the generation, transmission or distribution of electrical energy to join the Association in its Full Membership class. Many new members were elected under each class, and in the August issue of THE JOURNAL there will be published a complete list of membership revised to date, as well as a verbatim report of the principal amendments and changes which were made in the Constitution and By-Laws.

Two new departures were instituted, the first was the establishment of a Question Box, which has become an important feature of many engineering organizations, and the second was the institution of a Progress Department, the details of which will also appear in these columns later. As for the officers elected to serve during the ensuing fiscal year ending with June 20th, 1905, H. W. Goode, president of the Portland General Electric Company, Portland, Or., was elected President, C. H. Pennoyer, general manager of the Gas and Electric Company, San Jose, Cal., was elected Vice-President, and the offices of Secretary and Treasurer were combined and Geo. P. Low, editor of THE JOURNAL, was elected to fill them. Furthermore, Dr. F. A. C. Perrine was deputized to represent the Transmission Association at the International Congress of Electricians to be held in St Louis in September next.

PERSONAL.

Mr. F. M. Ray has severed his connections with the Brooks-Follis Electric Corporation to become associated with the Abner Doble Company as Pacific Coast manager of the Crocker-Wheeler Co.

Mr. John Bouse has become interested in the pattern works of George F. Buswell, Main Street, San Francisco, and will hereafter have charge of the business end. The plant is modern in its equipment, separate motors being used to direct connect the different machines.

Mr. H. A. Bullard, late manager of the Wagner-Bullock Electric Construction Company, of California, has accepted the position of salesman for electrical machinery of the National Electric Company of Milwaukee, Wis., under the Pacific Coast agency of Kilbourne & Clarke Co., of Seattle and San Francisco.

Mr. J. F. Burslem, general manager of the Yaqui River Mining Company, operating in Sonora, Mexico, is in San Francisco placing orders for placer mining equipment. An order was placed with the Byron Jackson Machine Works for two compound centrifugal pumps to pump 2000 gallons per minute against a head of 250 feet; five boilers of sixty horsepower each; a 250 horsepower, compound, self-contained condensing engine, and a complete lighting plant for a mine. A one-half-ton ice making plant will also be bought. Mr. Burslem states that the country in and about Sonora is rich in mineral, and a great many properties are being developed. Colonel Francisco Peinado, government representative in the State of Sonora, is highly commended for the assistance and protection he renders, especially to Americans, engaged in mining there.

Mr. A. M. Mattice, chief engineer of the Allis-Chalmers Company, has returned from his European tour of inspection, and has now settled down to the duties of his position in Milwaukee. While in Europe Mr. Mattice visited the hydraulic machinery works of Escher, Wyss & Co., of Zurich, and arranged important details concerning the manufacture in the United States of their lines of product. He also inspected the Nurnberg Gas Engine Works, at Nurnberg, and, at the well known engineering establishment of Williams & Robinson, at Rugby, England, he paid particular attention to the products and methods of manufacture of the Steam Turbine Advisory Syndicate, of which important organization Allis-Chalmers Company is the American member. Mr. Mattice had several important consultations in London with Mr. Yarrow, the famous torpedo boat builder, on the subject of turbines for marine purposes, and while on the Continent he made, in the Allis-Chalmers interests, a series of exhaustive tests of the Zoelly Steam Turbine, of which so much has recently been heard. The results of Mr. Mattice's European visit of inspection will be waited with a good deal of interest by American engineers.

BRITISH MECHANICAL ENGINEERS VISIT MILWAUKEE.

THE recent visit of the Institute of Mechanical Engineers of Great Britain to Milwaukee, in response to an invitation from the president of the Allis-Chalmers Company, was referred to by President Wicksteed, of the Institution, in his speech at West Allis:

"I do not know how these things are done," said he, "but this excursion has been perfectly managed. Two or three days ago in Chicago I met the president of this great company, and incidently remarked to him that I had long desired, as I knew many of my fellow members had, to visit the famous engine works in Milwaukee. President Warren asked 'when will it be convenient for you and your fellow members to come?' and I replied 'the day after tomorrow,' and here we are, transported in some sort of a magical way, quietly, comfortably, without any apparent effort, by arrangements which can only have been made over night, and yet are so admirably planned and carried out that they could not have been excelled had they been a long time in preparation. From the time we left the breakfast table in Chicago until we now return there in the evening, every movement has been thought out for us and every comfort provided. I want to say in behalf of the officers and council and members of the institution that this is the kindest and most thoughtful and most generous thing that has happened in my experience of travel. This day, in one of the model engineering works of the world, is one that no member of our institution now present will ever forget."

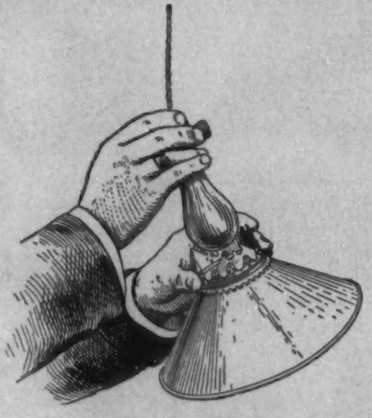
President Wicksteed, Secretary Worthington and other members of the institution said that in the way of industrial sights they had never seen anything more impressive than the huge erecting shop of the Allis-Chalmers Company, filled as it is with engines ranging from thirty to 12,000 horsepower in process of construction.

INDUSTRIAL

G. I. AUTOMATIC LAMP SHADE.

THERE is hardly any one using electric incandescent lamps who has not experienced the awkward, tiresome and (to the laymen) even dangerous methods of attaching a shade to an incandescent lamp shade holder over his desk in his office or along side of his easy chair at home.

The General Incandescent Arc Light Company in its constant efforts at supplying the trade with up-to-date electrical supplies



G. I. AUTOMATIC LAMP SHADE

and accessories is offering an automatic lamp shade, as above illustrated, which is light, ornamental and yet durable.

The holder attached to the shade is the latest and only device on the market.

It can instantly be put on or removed from any size electric lamp from four to twenty-four candlepower without removing the lamp from its socket, adjusting itself to the lamp automatically. It is the only shade with which this can be done.

It is economy to use this shade, not only on account of its low price, but because it will save valuable time and double the quantity of light thrown down by the lamp.

This shade can be used on an upright lamp (as on a portable) equally well by simply bending the arms up to right angles and adjusting from inside the hoder.

STEAM TURBINES IN CENTRAL DISTRICT SERVICE.

THE Merchants Heat and Light Company, of Indianapolis, recently placed an order with the Westinghouse Machine Company for two 750-kilowatt Westinghouse-Parsons turbine generating units to be installed as an addition to the present capacity of its power plant at Indianapolis. The new equipment will furnish light, heat and power throughout the commercial district of Indianapolis and the adjacent apartment residence district.

The Merchants Heat and Light Company was organized in 1902 by the representative wholesale and retail merchants of the city for supplying electricity and exhaust steam to the districts above named. The plant which was erected for this purpose was started on January 1, 1903, the initial installation consisting of 500 kilowatts in engine type direct connected units. The business has grown so rapidly that during the winter of 1903-04 the electric plant was taxed to its utmost capacity, necessitating the provision of additional future capacity. During this period, the heating system was increased by approximately 200,000 square feet of raditating surface utilizing the exhaust steam from the engines.

The present engineroom occupies 2500 square feet, and the building is being doubled to accommodate the present and future turbine equipment. The new edition will readily provide sufficient room for four 750-kilowatt turbine units, so that the completed plant will have 3000 kilowatts capacity in turbine installation in the same space as the present engine equipment of 500 kilowatts.

The turbines will operate on the exhaust heating system throughout the winter months. During this period, a back pressure of from three to five pounds will be carried, and during extremely cold weather, probably eight pounds. With this back pressure, the turbines will develop 20 per cent in excess of their rated capacity. During warm weather the turbines will operate condensing upon a Worthington condensing system giving twenty-seven inches vacuum referred to thirty inches barometer cooling towers will be employed.

The steam boiler plant is being extended to accommodate the new turbine equipment, and when completed will aggregate about 4220 horsepower in eleven units of Stirling and Wicks makes, the larger number being automatically fired by Roney mechanical stokers.

SPECIALIZATION IN MACHINE SHOP PRACTICE

AN important innovation in the engineering and commercial organizanion of an electrical manufacturing company is made known in the following announcement issued by the Crocker-Wheeler Company:

The equipment of factories with electrical motors for individual and group drive of machine tools has become such an extensive department of our business that we are warranted in going a step further. We are now prepared to give our clients expert advice upon the latest ideas and results in shop practice, in addition to purely engineering advice upon the design and installation of electrical apparatus for shop equipment, which we have been giving for a number of years and for which we now enjoy a considerable reputation.

INDUSTRIAL

To this end we have retained the well-known firm of Dodge & Day, modernizing engineers, of Philadelphia, Pa. We place the services of this firm at the disposal of our customers, giving them gratuitously the benefit of its wide experience and data. It is hardly necessary to refer to the well known reports which it has made or to the thoroughness and value of its investigations in shop methods. These are already familiar to the engineering world.

The experience of the electrical engineer alone does not fully cover the numerous factors that are met in these days of the dividend-making management of machine shops. While the economies that may be effected by electric drive are conceded by all, the actual savings accomplished depend entirely upon the intelligence with which the apparatus is selected, installed and used.

The advice and recommendations about which our customers may consult this firm need not be confined to electrical details, but may include all problems of shop equipment and management.

STEEL PIPE WELDING IN SAN FRANCISCO.

ANNOUNCEMENT is made by the Abner Doble Company that it is now fully equipped to engage in that which is, for San Francisco, a new and important branch of steel manufacturing, namely in the welding of steel pipe ranging in thickness from five-sixteenths to one inch, and in diameter from twenty-four inches to ten feet. The pipe is made of a special quality of steel and is welded by a process which maintains the full strength of the plate at the welded part. Tests made at the Watertown Arsenal, Massachusettes, of three pieces cut from the welded part cylinders, welded in the usual manner without references to any test purposes, show an ultimate strength ranging from 60,120 to 61,780 pounds per square inch. The importance and advantage of being able to obtain welded steel pipe in diameters larger than thirty inches will be fully appreciated by power plant engineers. The pipe can be furnished in lengths of sixteen feet with the ends prepared for "bumped," bell and spigot, or butt strapped joints; or with cast iron flanges riveted on, or with soft steel flangs welded on, as may be desired.

THE CENTURY ELECTRIC COMPANY EXPANDS.

THE Century Electric Company, of San Francisco, recently changed its name to the Century Electric Corporation, and is carrying through plans to greatly enlarge its business in the electrical field. The company has secured a building, six stories and a basement, on Second Street, near its present quarters, which it will ocuupy about the first of August, and where it will carry a complete stock of electrical machinery and supplies. A permanent organization under the new name has been effected by the election of F. M. Greenwald, president; C. M. Wood, vice-president and general manager; E. F. Weihe, secretary and treasurer, and L. D. Hitzeroth, engineer. The president, Mr. Greenwald, is well known to the trade on the Coast, having been identified with the California Electrical Works for over twenty years.

NERNST LAMPS IN CHICAGO.

THAT the Nernst lamp is rapidly coming into favor in the city of Chicago is evident by the fact that many of the company's customers are placing orders to increase the size of their Nernst lamp installations. Among these may be mentioned Armour & Company, also Nelson & Morris at the Union Stock Yards. The former company have recently added six six-glower and nine three-glower Nernst lamps to their system, while Nelson & Morris have increased their already large installation with twelve three-glower Nernsts. In this connection it may be mentioned that Swift & Company in the same locality have 125 six-glower and 750 three-glower Nernst lamps in satisfactory operation.

Abner Doble Company has just issued a dainty brochure on "Tangential Water Wheels," which illustrates and describes several of the interesting features of the Doble ellipsoidal water wheel, and the Doble needle regulating nozzle. Some eighteen pages of valuable water wheel and hydraulic pipe data supplement the pamphlet, which is known as "Bulletin No. 5," and is mailed gratuitously on application to Abner Doble Company, San Francisco.

RISDON DREDGERS FOR FOREIGN LANDS.

That the products of the manufacturers of this part of the country are not confined to their distribution to domestic users is indicated by orders that are being constantly received for shipment to almost all parts of the globe. Among them should particularly be noted an order to the Risdon Iron Works for a gold dredge from the Diamantina Mining Company, Diamantina, Brazil. Also an order to the same company for a gold dredge from the Phililpine Gold Mining Company, P. I. The company has just installed three dredges on the west coast of Africa.

A GREAT CHICAGO CONCERN IN SAN FRANCISCO.

The Electric Appliance Company, with headquarters at Chicago, has secured a large store room in the new Wilcox Building, 719 Mission Street, where it will open a branch store to supply the Coast trade. A complete line of electrical appliances will be carried. The company expects to be ready to supply prompt orders by the first of August. C. C. Hillis has been appointed general manager of this branch and F. J. Cram, who is well known on the Coast, having travelled for this company for the past nine years, is sales manager.

The Madison Mercantile Company, 35 Steuart Street, San Francisco, has added an engineering and machinery department to its business; to engage in designing, constructing and equiping complete street railway, steam, electrical and general power plants. A specialty will be made of central station electric pumping plants. The company is also handling second-hand electrical apparatus, and is the distributing agent for the Kerr Boiler Compound Company. Mr. I. B. Funk, formerly chief engineer and superintendent of construction for the Monterey County Gas and Electric Company, is in charge of the new department.

The United Iron Works has recently engaged in the manufacture of centrifugal pumps and step-pressure pumps, the latter for use particularly for direct-connection to electric motors. The company has turned out eight step-pressure pumps during the past thirty days to be direct-connected to motors up to fifty horsepower. It also received the contract, recently, for one forty-four-inch and one thirty-six-inch centrifugal drainage pump from the Bouldin Island Reclamation Company.

The Electric Storage Battery Company, of Philadelphia, has taken a residence at 4472 Forest Park Boulevard, St. Louis, for the use of members of its staff attending the Louisiana Purchase Exposition. The company's exhibit, which is the largest and most comprehensive that has ever been made by a storage battery company, is practically complete. It contains many interesting features, showing the recent developments in storage battery practice.

The Tracy Engineering Company, San Francisco, is preparing to install a complete steam power plant for the Haslett Warehouse Company, and has just completed the installation of a power plant for J. A. Folger.

May 1, 1904, marked the sixtieth anniversary of the successful operation of the Morse telegraph.

TRANSMISSION.

SUMPTER, OR.—The Beaver Company, owning the Baisley Elkhorn Mine, is to put in an electric transmission plant.—*Sumpter American.*

BLACK DIAMOND, CAL.—The Trustees have passed to print an ordinance granting an electric power franchise to D. C. Henny.—*Black Diamond Argus.*

SEATTLE, WASH.—The Prosser Falls Electric Company, contemplates installing electric lights and power in Mabton and Sunnyside.—*Seattle Bulletin.*

SALEM, OR.—The Commercial Club has adopted a resolution, offered by Hon. Tilman Ford, for the city to own and operate its own electric light plant.—*Salem, Journal.*

CITY OF MEXICO.—J. W. Taylor, of El Paso, Tex., is interested in a project to build an electric light and power plant al Huaynopita, a town in the State of Chihuahua.—*City of Mexico Herald.*

CORONA, CAL.—The Corona Gas and Electric Light Company has created a bonded indebtedness of $40,000 to complete and extend its plant and for other purposes.—*Riverside Enterprise.*

NANAIMO, B. C.—The electric light company intends to erect a new power house and plant to take the place of the present plant. Contracts aggregating $15,000 have been let.—*Victoria Colonist.*

TOMBSTONE, ARIZ.—The Trustees have adopted an ordinance granting a franchise to Charles L. Douglass to construct and maintain an electric light and power plant here.—*Tombstone Prospector.*

CARSON CITY, NEV.—A company is being organized to furnish power and light for the new camp at Goldfield. A. C. Eisen is president of the company and S. D. Foreman, manager.—*Carson City Appeal.*

PORTLAND, OR.—The City Council of St. Johns has granted a franchise to the Portland General Electric Company to erect and maintain wires in that city for furnishing light and power.—*Portland Oregonian.*

SANTA ROSA, CAL.—Preparations are being made to establish an auxiliary electric light plant and power system at Healdsburg. The new plant will be fitted with oil burners, and it is estimated to cost about $10,000.—*Santa Rosa Press-Democrat.*

FORT STEELE, B. C.—The Elk River Power and Light Company will proceed at once to install a large power plant at Elk River Falls. The company will furnish electric power to all industries in the Crows Nest Pass.—*Fort Steele Prospector.*

MARYSVILLE, CAL.—Attorney B. Irish has located 15,000 inches of water of the North Yuba River at this place. Two electrical power plants are to be located in Yuba County, one near the mouth of Slate Creek and another near Bullard's Bar.—*San Francisco Chronicle.*

OROFINO, IDAHO.—The Orofino Mill and Power Company has about completed organization. A flour mill business will be conducted. It is possible an electric light plant will be installed. Messrs. Fuller and Hunsperger are interested in the enterprise.—*Lewiston Teller.*

MAPLE FALLS, WASH.—Manager Asplund, of the B. B. Shingle Company, is negotiating for the establishment of an electric light plant for the lighting of their mill. Mr. Asplund is also considering the matter of furnishing light to the entire town.—*Maple Falls Leader.*

NOGALES, ARIZ.—The La Brisca Company will put in an immense electric plant at Magdalena to light and run its works F. E. Monteverde, Jr., of Hermosillo, Mex., was in Magdalena recently looking over the ground with the view of putting in a plant there.—*Nogales Oasis.*

RENO, NEV.—As soon as the report of the Washoe Power and Development Company's electrical engineer is received, all the machinery and equipment for the proposed power plant will be ordered. J. E. Humphrey is president of the company and F. H. Norcross, secretary.—*Reno Gazette.*

REDLANDS, CAL.—The Department of the Interior has decided the ownership of power rights in Santa Ana River against the Mentone Power Company and in favor of the Edison Electric Company. The power house of the Edison Company will be completed in several months.—*Redlands Review.*

REDDING, CAL.—The Northern California Power Company proposes to install a pumping station, to be operated by electricity, at a point on the Sacramento River just beyond the western limits of the city, and to pump water from the river to a reservoir in the extreme western part of the city.—*Redding Searchlight.*

HEALDSBURG, CAL.—J. L. Bates, City Clerk of Healdsburg, is advertising for sealed proposals for furnishing machinery for an electric plant. A complete description of each engine, boiler or generator to accompany each bid. Information will be furnished upon application. The bids are to be in by 6 p. m.—*Healdsburg Sun.*

PORTLAND, OR.—The Gold Hill Development Company, represented by H. Schaeffer, has purchased water and power privileges from J. J. Houck and proposes to furnish electric power for all purposes. It will be necessary to construct a canal 2100 feet long, fifty feet wide and eight feet deep, with twenty-six feet constant head.—*Portland Telegram.*

REDDING, CAL.—A petition for a franchise to erect and maintain poles and wires for carrying electricity throughout the streets and thoroughfares of the city has been presented to the Trustees by Judge Edward Sweeney, as attorney for Harry L. Shannon, the petitioner. A proposed ordinance inviting bids for the franchise was passed to print.—*Redding Searchlight.*

SEATTLE, WASH.—Work has been commenced on the Snoqualmie Falls power plant improvements. It is the intention to increase the capacity of the plant by several thousand horsepower by raising the height of the dam and putting in new machinery. The plant of the Seattle Electric Company, at Electron, is nearing completion.—*Seattle Post-Intelligencer.*

HAMILTON, ONT.—The Canadian Westinghouse Company (Ltd.) has closed a contract to furnish the Shawinigan Water and Power Company, Shawinigan Falls, P. Q., with a 6600-kilowatt, two-phase, 2200-volt generator for direct connection with a water wheel. Two 2200-kilowatt, oil insulated, water cooled transformers, 2200-volt primary, 50,000 secondary, are included in this contract.

BOISE, IDAHO,—The Crane Falls Power and Transportation Company, with headquarters at Boise, has been incorporated for the purpose of erecting a power plant in Owthee County, at Crane Falls, for the generation of electric power to operate the company's several plants. William D. Bean, Thomas J. O'Neill, A. J. Nothacher, of New York, and others, are the directors—*Boise Statesman.*

REDDING, CAL.—Suit has been filed in the Superior Court to condemn a site for a power plant on the banks of the Trinity River about two miles below Junction City. The North Mountain Power Company commenced the proceedings through Attorney William C. Bissell. As soon as the site is secured, they will commence the erection of building to accommodate the machinery for generating electric current.—*Redding Searchlight.*

SAN FRANCISCO, CAL.—The G. W. Price Pump Company is installing a pumping plant for J. H. Williams, Porterville. The pump, which will have a capacity of 1200 gallons per minute, will be direct-connected to a forty horsepower motor, and is being installed in a tank sunk thirty-five feet in the ground. The company has just completed the installation of a 1000 gallon per minute plant for the Modesto Gas Works, Modesto, to furnish water for the city.

VIRGINIA, NEV.—Negotiations have been going on for some time past between representatives of the Comstock Mining Company and the Truckee River General Electric Company for the installation of a second electric power plant to supply the mines with the additional power that will be needed in the operations

which have been planned. A site for the proposed duplicate plant has been selected, and is about two miles below the existing plant on the Truckee River.—*Virginia Chronicle.*

OGDEN, UTAH.—A power plant is to be built at Weber Canyon for the generation of 2000 horsepower. The Utah Construction Company is acting for the locators. The work is a continuation of the development already done by A. F. Parker, city engineer, and E. W. Wade, agent of the Utah Power and Railroad Company. The plan is to take the water out of the Weber River, near Strawberry Creek, and convey it by pipe line around the north wall of the canyon. Reservoirs are to be built.—*Ogden Journal.*

SAN FRANCISCO, CAL.—The Sawtooth Power Company, Starr-King Building, San Francisco, has appointed John Bouse, of the Bouse Company, 503 Mission Street, as consulting and supervising engineer for an electric transmission plant which the company will build at a point on the Nome River, about sixty miles above Nome, Alaska. The object of this installation, which will be the first of its kind in that part of the country, is to supply power to bench claims. The plant will generate about 5000 horsepower. The feed line will extend from forty to sixty miles and the individual distributing lines from two to fifteen miles. Slow speed motors will be installed to be direct-connected to centrifugal pumps for individual supply. Mr. Bouse is preparing specifications, and bids will be closed before Fall. It is the company's object to have the plant in operation by July, 1905.

TRANSPORTATION.

SUISUN, CAL.—Bids will be received by the Trustees up to 8 p. m., July 12th, for a franchise to construct and operate a street railway along certain streets in Suisun.—*Suisun Republican.*

SAN JOSE, CAL.—Plans are being formulated for the construction of an electric railway from this city to Berryessa. Mehling & Lockwood are the promotors of the enterprise.—*San Jose Mercury.*

EUREKA, CAL.—The Council has accepted the bid of J. C. Bull, Jr., for a franchise for an electric road over certain streets in Eureka. Mr. Bull was the only bidder for the franchise.—*Eureka Times.*

STOCKTON, CAL.—The Supervisors of San Joaquin County have passed an ordinance granting permission to H. H. Griffiths to erect and operate an electric railway over certain streets in the county.—*Stockton Record.*

LEWISTON, IDAHO.—At the last meeting of the Council a petition was read from Judson Spofford and assigns for a franchise to construct a street railway. No definite action was taken in the matter.—*Lewiston Tribune.*

SPOKANE, WASH.—The Washington Water Power Company will apply for a franchise from the city to run a car line across the proposed Hangman Creek Bridge into the West Grove Addition.—*Spokane Spokesman-Review.*

SPOKANE, WASH.—The Amador Consolidated Mining Company is preparing to construct an electric line thirteen miles long giving transportation right to their mines located near Mullen, Idaho.—*Spokane Spokesman-Review.*

EUREKA, CAL.—The Supervisors of Humboldt County will receive bids up to 10 a. m., July 18th, for a franchise to construct and operate an electric railway along the county road leading from Eureka to Arcata, as applied for by the Humboldt Transit Company.—*Eureka Standard.*

VACAVILLE, CAL.—Vice-president J. W. Hartzell and Chief Engineer M. K. Miller have been going over the right of way for the Vallejo and Napa electric road preliminary to actual construction work. It is planned to extend the line to Winters later on. —*San Francisco News Bureau.*

MARYSVILLE, CAL.—The preliminary survey of the route for the proposed electric railroad from Marysville to Downieville, in Sierra County, has begun. George F. Taylor, civil engineer, is in the field with a corps of assistants and will complete the work as soon as possible.—*Sacramento Bee.*

SALT LAKE, UTAH.—The Salt Lake and Ogden Road is to be converted from a steam to an electric system, and is to be extended to Ogden. Simon Bamburger has interested a syndicate of California capitalists in the scheme, and the project is to be pushed to completion.—*Salt Lake News.*

SAN JOSE, CAL.—The Supervisors of Santa Clara County will receive bids up to 10 a. m., July 6th, for a franchise to construct and operate a single track standard gauge electric railroad over certain highways in Santa Clara County, as applied for by the San Jose-Los Gatos Interurban Railway Company.—*San Jose Mercury.*

CLARKSTON, WASH.—Greenville Holbrook, right of way agent for the Southeastern Electric Company, states that two-thirds of the proposed right of way for this end of the line has been secured. It is estimated that $3,000,000 will be required to construct and equip the line from Lewiston to Greenville and Nez Perce—*Portland Journal.*

LOS ANGELES, CAL.—In ten days Bay City will be connected by electric trolley with Los Angeles, and in two weeks the cars of the Huntington system will be operated to and from Anaheim Landing. By July 15th, General Manager Schindler, of the Pacific Electric Railway, states that the company will be running to Newport Beach, a distance of thirty-eight miles.—*San Francisco News Bureau.*

SAN JOSE, CAL.—It is announced that Boston capitalists will construct an electric railway this fall from San Jose to Palo Alto, connecting all the towns between these two points. C. B. Good, agent of the Boston syndicate, has been in this section for two months mapping out a route. The extension of the San Jose electric road from Delmas Avenue to Campbell will also be undertaken at once.—*San Francisco Chronicle.*

NEW INCORPORATIONS.

SAN DIEGO, CAL.—The Southern Electrical Company; capital stock, $10,000; incorporators, J. B. Osborn, S. A. Wright, A. H. Bilwener, *et al.*—*San Francisco News Bureau.*

LOS ANGELES, CAL.—Santa Maria Power and Lighting Company; capital stock, $50,000; directors, H. T. Duff, W. F. Gibbs, R. H. Pallard and F. C. Armstrong.—*San Francisco News Bureau.*

SAN FRANCISCO, CAL.—Shasta Power Company; capital stock, $1,000,000; incorporators, H. L. Shannon, F. Kingsbury, T. J. O'Brien, Charles Jacobson and J. W. Potts.—*San Francisco News Bureau.*

SAN FRANCISCO, CAL.—Bauer Lamp, Reflector and Electric Company; capital stock, $25,000; incorporators, George Gottschamer, Otto, George and Theresa Bauer.—*San Francisco News Bureau.*

SAN FRANCISCO, CAL.—Mt. Lassen Water and Power Company; capital stock, $500,000; incorporators, Archibald Barnard, L. M. Robbins, A. G. Sheath, M. A. Kenny, *et al.*—*San Francisco News Bureau.*

REDDING, CAL.—Redding, Ingot and Wengler Telephone Company; capital stock, $10,000; incorporators, Herbert Bass, Matt Wengler, N. G. Scott, R. A. Ward and A. Berg.—*San Francisco News Bureau.*

LOS ANGELES, CAL.—Southern California Electric Mirror Advertising Company; capital stock, $50,000; incorporators, E. I. Tolle, W. E. Hutchason, George A. Butler and others.—*San Francisco News Bureau.*

ADIN, MODOC COUNTY, CAL.—Adin Electric Light and Power Company; capital stock, $10,000; incorporators, G. H. Knight, E. S. Pickard, Nettie B. Harris, E. M. and L. A. Wilson.—*San Francisco News Bureau.*

LOS ANGELES, CAL.—San Fernando Valley Home Telephone Company; capital stock, $50,000; incorporators, C. F. Guthridge, C. L. Zahn, Arthur Wright, D. F. Boyce and C. P. Platt.—*San Francisco News Bureau.*

SAN FRANCISCO, CAL.—San Benito Water, Light and Power Company; capital stock, $300,000; incorporators, L. A. Gibbons, A. I. Kittle, G. T. Drinkwater, J. R. Keith, G. E. Bennett.—*San Francisco News Bureau.*

LOS ANGELES, CAL.—Pacific Coast Telephone Construction Company; capital stock, $25,000; incorporators, C. F. Guthridge, C. L. Zahn, Arthur Wright, D. F. Boyce and C. P. Platt.—*San Francisco News Bureau.*

SAN DIEGO, CAL.—Clarke-Brant Electrical Company; capital stock, $25,000, of which $850 has been subscribed; incorporators, H. P. Burns, J. T. Weldon, T. W. Coates and A. D. Jordan.—*San Francisco News Bureau.*

SAN FRANCISCO, CAL.—North Trinity Telephone and Telegraph Company; capital stock, $5000, of which $3500 has been subscribed; incorporators, Leo Muhd, J. R. Kennedy, W. H. Mead *et al.*—*San Francisco News Bureau.*

STOCKTON, CAL.—The Central California Electrical Company; capital stock, $500,000; incorporators, J. L. Gibbs, J. E. Conde, *et al.* It is the intention of the company to operate solely in Tuolumne County, as the field is sufficiently large to use all the power the company can generate.—*Stockton Independent.*

ALBUQUERQUE, N. M.—The Rio Grande Irrigation and Power Company. The company has incorporated for the purpose of constructing dams, reservoirs, canals, pipe lines, developing power for electricity and conducting water for all purposes to generate electricity and maintain appliances for distribution. Names of incorporators not given.

MONTEREY, CAL.—As soon as the newly constructed branch line from Alvarado Street to Ord Barracks is in operation, the Monterey and Pacific Grove Railway Company will begin the work of extending the main line from its present terminus at Assembly Hall, Pacific Grove, to the depot and beach in that town. Work on this extension will be commenced at once.

COMMUNICATION.

PHŒNIX, ARIZ.—The Phœnix Independent Telephone Company is seeking to establish a new telephone system here.—*Los Angeles Times.*

LOS ANGELES, CAL.—The Home Telephone Company is preparing to put a system of wires throughout Eagle Rock Valley.—*Los Angeles Times.*

SALEM, OR.—The Pacific States Telephone and Telegraph Company is planing to give its system in Salem a complete overhauling.—*Salem Journal.*

MONROE, WASH.—The Tulaco Telephone Company, with headquarters at this place, will install a local telephone system in the near future.—*Seattle Bulletin.*

DAYTON, OR.—R. N. Snell, F. B. Post and J. W. Martin have incorporated for the purpose of carrying on a telephone business at Dayton Or.; capital stock, $3000.—*Salem Statesman.*

SPOKANE, WASH.—Seth Woodward is securing new subscribers for the Pacific States Telephone and Telegraph Company for new telephone lines extending to within two miles of Trent.

WALLA WALLA, WASH.—I. H. Olson, J. P. McMinn and Charles C. Madden are directors of the new telephone company recently organized here. Work on the line will begin at once.—*Walla Walla Union.*

SANTA ROSA, CAL.—The Mark West Creek and Santa Rosa Creek Telephone Company; incorporators, R. W. Peterson, H. L. Hall, J. M. Laughlin and others; capital stock, $15,000.—*Santa Rosa Press-Democrat.*

PENDLETON, OR.—The Pendleton-Birch Creek Telephone Company has been organized and work on the new line will begin about July 1st. The line will be built from Pendleton to Pilot Rock.—*Pendleton East Oregonian.*

PHŒNIX, ARIZ.—The Phœnix Independent Telephone Company; capital stock, $100,000; incorporators, H. M. Joy, Joseph H. Kibbey, Arthur J. Edwards. Object, to establish and construct a telephone system.—*Phœnix Republican.*

PORTLAND, OR.—Citizens Light and Traction Company; capital stock, $200,000; incorporators, A. Welch, I. Lowengart, L. Langman, M. Hoff and Louis Sommer. Object, to construct all kinds of electrical plants, etc.—*Portland Journal.*

BAKER CITY, OR.—The County Court has granted to the Express Telephone and Telegraph Company permission to erect poles and string wires along the county roads near Durkee for telephone purposes.—*Baker City Democrat.*

SONOMA, CAL.—J. B. Small, City Clerk, will receive bids up to 8 p. m., August 3d, for a franchise to coustruct and maintain a telephone line and system on the streets of Sonoma, as applied for by Louis Breitenbach.—*Sonoma Index-Tribune*

DILLON, MONT.—The Rocky Mountain Bell Telephone Company intends to make a number of improvements in its system here. A new switchboard will be put in at the central station and the line about town will be rebuilt.—*Dillon Tribune.*

DOS PALOS, CAL.—The promoters of the telephone system here have arranged to incorporate at once and put in an independent line between the Center and Dos Palos station. Connection will be made with the Miller and Lux system.—*Dos Palos Star*

SANTA ROSA, CAL.—The Supervisors of Sonoma County have adopted ordinances granting to T. G. King, George W. Gaston, John R. Denman, J. H. Coltoft, *et al.*, the right to erect and maintain telephone lines along the roads of Sonoma County.—*Santa Rosa Press-Democrat.*

SANTA ROSA, CAL.—John McClish has filed an application for a rural telephone service franchise. The proposed system will extend from Healdsburg along Dry Creek, across Mill Creek and along the Western side of Russian River to Korbel's station. Other petitions for franchises are being arranged for.—*Santa Rosa Press-Democrat.*

SANTA ROSA, CAL.—Residents of Green Valley, have decided to join with the Santa Rosa and Mark West Telephone Company in the construction of a line to Santa Rosa. District Manager N. L. Jones, states that other sections of the county are getting ready to organize rural systems. The company will construct a new loop from Cloverdale to Santa Rosa.

HEALDSBURG, CAL.—The citizens of Upper Dry Creek Valley are considering the matter of erecting a rural telephone line to extend from Thompsen Brothers.' ranch, about three miles up in the valley, to Geyserville, a total distance of about nine miles. A. W. Pritchett, D. F. Paternack and C. Wagele have been appointed a committe on construction.—*Healdsburg Sun.*

GAS.

HONOLULU, T. H.—Work will soon commence on the gas system authorized by Congress. W. R. Castle says in regard to the enterprise: "The present plan is to establish works with large supply power, and with twelve to thirteen miles of mains. We are considering whether to make gas from coal or oil; but the latter is preferable and we shall probably use oil. The only proposition now is to make fuel gas—we have no intention at present of manufacturing it for illuminating purposes. We intend to extend the mains only to the more thickly populated districts at the start. The franchise is held by the estate of W. W. Dimond and by A. N. Campbell, W. R. Castle and William J. Landers, of San Francisco. There is ready for investment between $250,000 and $300,000, with which the company will be incorporated, and as the plant and mains are extended new stock will be issued to cover the additional cost."—*San Francisco News Bureau.*

MISCELLANEOUS.

SAN FRANCISCO, CAL.—The Holmes Lime Company is establishing, at Old Felton, Santa Cruz County, what will be the first plant of its kind on the Pacific Coast—a plant for the manufacture of lime by hydration.